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Wings Outstretched: New Contributions in Undergraduate Research

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Wings Outstretched: New Contributions in Undergraduate Research



2016

Ronald E. McNair Scholars Journal

Portland State University

About the Program

The Portland State University (PSU) Ronald E. McNair Scholars Program at Portland State University works with motivated and talented undergraduates who want to pursue PhDs. It introduces juniors and seniors who are first-generation and low-income, and/or members of under-represented groups to academic research and to effective strategies for getting into and graduating from PhD programs.

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The Ronald E. McNair Post-baccalaureate Achievement Program was established in 1986 by the U.S. Department of Education and named in honor of Challenger Space Shuttle astronaut Dr. Ronald E. McNair. The program, which has been on campus since 2003, is funded by a \$1,155,000 grant from the U.S. Department of Education and institutional cost-share funds.

The McNair Scholars Program's student-centered approach relies heavily on faculty and university commitment. Activities and opportunities provided by the program focus on building a positive academic community for the scholars while they are undergraduates at PSU.

About Ronald E. McNair

Ronald Erwin McNair was born October 21, 1950 in Lake City, South Carolina. While in junior high school, Dr. McNair was inspired to work hard and persevere in his studies by his family and by a teacher who recognized his scientific potential and believed in him. Dr. McNair graduated as valedictorian from Carver High School in 1967. In 1971, he graduated magna cum laude and received a Bachelor of Science degree in Physics from North Carolina A&T State University (Greensboro). Dr. McNair then enrolled in the prestigious Massachusetts Institute of Technology. In 1976, at the age of 26, he earned his Ph.D. in laser physics. His dissertation was titled, "Energy Absorption and Vibrational Heating in Molecules Following Intense Laser Excitation." Dr. McNair was presented an honorary doctorate of Laws from North Carolina A&T State University in 1978, an honorary doctorate of Science from Morris College in 1980, and an honorary doctorate of science from the University of South Carolina in 1984.

While working as a staff physicist with Hughes Research Laboratory, Dr. McNair soon became a recognized expert in laser physics. His many distinctions include being a Presidential Scholar (1971-74), a Ford Foundation Fellow (1971-74), a National Fellowship Fund Fellow (1974-75), and a NATO Fellow (1975). He was also a sixth degree black belt in karate and an accomplished saxophonist. Because of his many accomplishments, he was selected by NASA for the space shuttle program in 1978.

His first space shuttle mission launched successfully from Kennedy Space Center on February 3, 1984. Dr. Ronald E. McNair was the second African American to fly in space. Two years later he was selected to serve as mission specialist aboard the illfated U.S. Challenger space shuttle. He was killed instantly when the Challenger exploded one minute, thirteen seconds after it was launched. Dr. McNair was posthumously awarded the Congressional Space Medal of Honor. After his death in the Challenger Space Shuttle accident on January 28, 1986, members of Congress provided funding for the Ronald E. McNair Post-Baccalaureate Achievement Program. Their goal was to encourage low-income and first-generation college students, and students from historically underrepresented ethnic groups to expand their educational opportunities by enrolling in a Ph.D. program and ultimately pursue an academic career. This program is dedicated to the high standards of achievement inspired by Dr. McNair's life.

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Why Are Russian Youth Less Supportive of Democracy than Older Generations?

by
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Abstract

What explains support for democracy among Russian youth? Studies in political socialization conducted in the early 1990s, incorporating generational change, suggest that Russia's main obstacle to the consolidation of democracy was nostalgia for the Soviet Union. The passing of time now allows for the inclusion of the post-Soviet generational cohort, also referred to as the Putin Generation. The post-Soviet youth are a byproduct of political instability and economic turmoil with little or no direct personal experience of the Soviet period. These developments allow for new theoretical mechanisms related to government legitimacy to be included in the analysis. Drawing upon 2011 survey data conducted by the World Values Surveys, this article seeks to advance our understanding of why generational change affects attitudes toward democracy. It extends the literature in two ways: firstly, by adding a new political generation; and secondly, by incorporating government legitimacy into the analysis explaining support for democracy.

Keywords: Russian Youth, Post-Soviet Generation, Generational Change, Generation Effect, Cohort Effect, Modernization, Government Legitimacy

Introduction

Literature on political socialization, specifically, generational change, conducted in the early 1990s suggest that Russia's main obstacle to the consolidation of democracy was nostalgia for the Soviet Union.¹ Conventional wisdom suggests that younger generations are more inclined to express support for democracy. Previously surveyed Russian populations were unique in that they came of age under two different socioeconomic and political systems during the nation's transitional period. One study conducted at the turn of the century, following the collapse of the Soviet Union, found that younger Russians held a more favorable view of democracy and capitalism than older Russians.² The elapse of time now offers the post-Soviet generational cohort for consideration. This article places emphasis on the Putin Generation³, those who have come of age during Putin's presidency (or those born between 1980 and 1992), that is living under the new sociopolitical and economic system. In the matter of a decade, the notion of youth in modern-day Russia as a subject of government policy is quite different from that of the Soviet Union. Unlike their parents, young Russians in the twenty first century do not have an established career trajectory. The new Russian youth are a byproduct of political instability and turbulent free-market transition with little or no direct experience of the Soviet era.

Drawing upon the political socialization literature, this article seeks to improve the current literature's understanding of the attitudes of the post-Soviet cohort and how the period in which they came of age has shaped their outlook on politics and society. Understanding the political consciousness of the Putin Generation, which emerged out of political and economic turmoil, and how that consciousness was formed gives researchers insight into what kind of citizens young Russians will be. This will be the next generation that will occupy various occupations within the government, vote in elections, work in the private sector and become academics; they will also share their views and opinions with future generations. Additionally, considering Russia's one-year of service obligation, these young men and women are currently or will be active military men and women of the state.

Using the 2011 World Values Survey, this article seeks to understand the extent to which generational change is affecting demand for democracy. The present analyses, using two OLS regression models, reveal that age positively predicts satisfaction with government and demand for democracy in only one instance – the Brezhnev Generation. Furthermore, by incorporating government legitimacy as a variable, the study reveals that better perceptions of government performance positively impacts demand for democracy.

Who are the Post-Soviet Youth?

How have the events of the early 2000s affected the political orientation of Russia's youth? Though there may be debate as to the relative importance of specific developments, the period between the late 1990s through the 2000s has been a transformative period. A young Russian born in 1980 would have been 18 years of age at the time of the financial meltdown of 1998 and 20 years of age when Putin became president in 2000 after launching the Second Chechen War. At the other end of the post-Soviet cohort, a Russian born in 1992 would have been 12 when Mikhail Khodorkovsky, liberal opposition and oil billionaire, was arrested and put on trial. Those born in the early 1980's spent their formative years hearing about the Russian state and Chechen separatist. Further, due to rising oil and natural gas prices, the country experienced significant GDP growth throughout the 2000s. The broader context of the latter half of the transition period provides an interesting case

¹ Olena Nikolayenko, 2008

² Michael McFaul, "Generational Change in Russia," *Demokratizatsiya: The Journal of Post-Soviet Democratization*, no. 11 (2003): 64-79.

³ Mendelson and Gerber, "US and Them: Anti-American Views of the Putin Generation," *The Washington Quarterly* (2008).

study to determine how highly visible political and economic events affected the political orientation of Russia's youth.

According to the CIA Factbook, Russian youth (those between 15 and 25) today make up nearly 11 percent of the population. If combined with the proceeding cohort of young Russians, who have yet to come of age, the total is 27 percent or one-fourth of the population. The largest age group is made of those between 25 and 55, which accounts for roughly 46 percent of the population. If generational change is occurring, those values and beliefs may be reflected in future populations.⁴

The post-Soviet cohort is the first generation to truly harness the power of the internet, utilizing social media sites, such as V Kontakte and Odnoklasniki. 40.8 percent of individuals, in a study carried out by Diuk (2010), responded that they use the internet during their leisure time.⁵ While computer utilization has increased, with respect to news source, more than 90% reported that they gather news from television.⁶ The higher percentage suggests that young Russians are formulating opinions based on the news controlled by the Putin regime. The means by which young people receive their news is likely to affect their attitudes.

Generation Effect

The Russian youth, or generational change, have been considered the "beacon of hope" for democracy in Russia.⁷ Following the collapse of the Soviet Union, Russia was the sight of one of the world's most profound sociopolitical and economic transformation in modern history. Conventional wisdom suggests that younger people are inherently more progressive than older people in terms of their sociopolitical values and beliefs. Generation effect theory suggests that the formative period in which an individual comes of age under unique circumstances has the potential to shape certain attitudes of a generation; the studied phenomenon is described as a "generation effect" or "cohort effect."⁸ Further, in developing countries, such as Russia in the early 1990s, periods of dissatisfaction with government performance may affect political system preference,⁹ and/or undermine the political efficacy of a democracy.

Mendelson and Gerber (2008), drawing upon survey data from the 2000s, argue that the Putin themes, which are resonating with youth, may be acting as an ideological barrier to support for democracy.¹⁰ Further, the scholars argue that an authoritarian political culture may be developing among Russian youth.¹¹ While some evidence of generational change has been found,¹² even more speculated that the initial optimism about democracy and capitalism would be squashed by disappointment.¹³

The study of political generations and generation effects is contentious. Only highly visible and frequently discussed events are likely to resonate with young people. The post-Soviet cohort, as noted, came of age during a historical period of Russia's transition. The socialization literature also notes that attitudes have the potential to change over time, especially passes through various

⁴ CIA Factbook, 2015.

⁵ Nadia Diuk, *"The Next Generation in Russia, Ukraine, and Azerbaijan: Youth, politics, identity, and change,"* Plymout, UK: Rowman & Littlefield Publishers, INC, 2010.

⁶ Diuk, "Next Generation."

⁷ McFaul, "Generational Change."

⁸ Mark Tessler, Carrie Konold, and Megan Reif, "Political Generations in Developing Countries Evidence and Insights from Algeria." *Public Opinion Quarterly*, no. 68.2 (2004): 188

⁹ Tessler, "Political Generations," 191.

¹⁰ Mendelson and Gerber, "Anti-American Views of the Putin Generation," 132.

¹¹ Mendelson and Gerber.

¹² McFaul, "Generational Change."

¹³ McFaul, Diuk.

stages in life, including college, employment, marriage, child-rearing, and retirement.¹⁴ The most promising area of study on generation effects is in countries that have undergone a period of sociopolitical and economic instability.

Those born between 1980 and 1992 constitute as a political generation.¹⁵ This cohort passed through their formative during a period of nation building, the curtailment of political rights, and military conflict. More importantly, the Putin Generation came age during an economic rebound. There is reason to believe that the combination of these events have shaped the attitudes towards democracy.

Modernization

At the turn of the millennium, nearly a decade after the collapse of the Soviet Union, Russia began its rebound from the economic meltdown of 1998. Likely due to the rise in oil and natural gas price, between 1999 and 2008 the national GDP grew at an unprecedented rate, with the average at more than 7 percent.¹⁶ For Putin's first 8 years in office, Russia had one of the world's fastest growing economies and real wages more than tripled.¹⁷ Furthermore, the national unemployment rate dropped from 12 percent in 1998 to 6.5 percent in 2011, with the lowest being 6 percent in 2007.¹⁸

Classical modernization theory argues that economic development, greater affluence, and urbanization foster support for democracy.¹⁹ In this study four indicators of modernization theory are considered: size of town²⁰, education level,²¹ social trust²², and interest in politics.²³ Schools, namely institutions of higher education, no longer follow the strict teachings of the Soviet doctrine, transforming curriculums; therefore higher levels of education may correlate with higher support for democracy. Further, the expansion of cities and the migration of people from rural areas to the city lead people to adopt new beliefs, facilitated by increasing education level and global awareness.²⁴ The aforementioned indicators of modernization diffuse the necessary conditions for complex, intelligent social interactions between citizens.

Government Legitimacy

In 2004, Russia's freedom rating changed from "partly free" to "not free," according to Freedom House. While most attention has been given to the antidemocratic tendencies of the Putin regime, little attention has been given to how government legitimacy impacts demand for democracy in Russia. In a learning module approach, in contrast to modernization theory and generation effect theory, Mattes and Bratton (2007) argue that demand for democracy is contingent upon the perceived supply of democracy rather than affluence and or generational change.²⁵ Data collected in 2010 revealed that Russian youth possess more material wealth than any preceding generation cohort.²⁶ When asked whether they believe they have the ability to change their circumstance, 72

¹⁴ Cooper and Denner 1998; Staudinger, and Lindenberger 1991; Magnusson, Bergman, and Rudinger 1991, as cited in Tessler et. Al 2004

¹⁵ Diuk.93.

¹⁶ Guriev and Tsyvinski, "Challenges Facing the Russian Economy after the Crisis." 9-10.

¹⁷ Guriev and Tsyvinski, 9, 12.

¹⁸ International Monetary Fund

¹⁹ Lerner, Traditional Society; Lipset, "Social Requisites"; Inglehart and Norris, "True Clash".

²⁰ Lerner, Traditional Society; Lipset, "Social Requisites".

²¹ Almond and Verba.

²² Lerner, Traditional Society.

²³ Lipset, "Social Requisites"; Lerner, Traditional Society

²⁴ Lerner, D The Passing of Traditional Society: Modernizing the Middle East (New York: Free Press, 1958

²⁵ Mattes and Bratton, "Learning about Democracy."

²⁶ Diuk.

percent responded positively.²⁷ Due to the benefits reaped by the increase in national GDP between the years of 1999-2008, Russians may attribute material wealth and economic rebound to government policy directed by the Putin regime,²⁸ affecting their perceived supply of democracy. Satisfaction with household financial situation is also used as an indicator of government legitimacy.

Throughout the 2000s, despite the curtailment of political rights, Putin has enjoyed high approval ratings, suggesting that the general population has approved of the government's performance.²⁹ In a comparative study from the MENA region, Benstead and Atkeson found that positive perceptions of governance (or supply of democracy), in the form of cracking down on corruption, within authoritarian regimes also positively relates to demand for democracy.³⁰ If democratic regimes cultivate and sustain democracy, it is reasonable to believe that Putin's authoritarian regime is producing similar results, in spite of findings that have found low support for democracy in Russia.³¹

Methodology

Using 2500 interviews from the 2011 World Values Survey, developed by Inglehart at University of Michigan, the present study seeks to explain what is affecting demand for greater democracy among Russian youth.

Depended variables, in this study, are a series of sociopolitical attitudes relevant to Russia. The first dependent variable, government legitimacy, is measured by gauging confidence in the (1) government in the nation's capital, (2) parliament, and (3) civil service. Another dependent variable, support for democracy, is measured by asking respondents how important it is for them to live in a country that is democratically governed. Respondents are asked to rate the importance of democracy on a scale from one to ten, with higher scores denoting greater importance.

Independent variables are dummy variables representing the imagined generation cohorts. Adopting a lenient model to test for generation effects employed by Tessler (2004),³² the "formative years" are defined as 18-25. Every respondent is assigned to an age cohort that corresponds to the historical period based on their age at the time of the 2011 World Values Survey interview. For example, the Generation Putin cohort consists of individuals born between 1980 and 1993, who were between the ages of 18 and 31 at the time of the survey in 2011. With the exception of the young Russians born after 1987, six or more years were spent within the hypothesized formative period. Generational cohorts can be identified by having shared depositions or collective memories that are durable and have the potential to outlast the periods in which they were formed, thus shaping the behavior and attitudes of an individual for a lifetime.³³ In other words, the impact of social and political events experienced during the formative years has the potential to define a generation's outlook on politics and society.

The number of respondents in each age cohort is as follows: Generation Putin, 1998 – 2011, N= 641; Generation Gorbachev, 1985 - 1997, N= 542; Brezhnev, 1964 -1984; N= 928; Khrushchev, 1946 - 1966, N= 389.

²⁷ Diuk, 14.

²⁸ Diuk, 9.

²⁹ Mendelson and Gerber, 136.

³⁰ Benstead and Atkeson, "Why does Satisfaction with an Authoritarian Regime Increase Support for Democracy?"

³¹ Inglehart, "Mass Support for Democracy".

³² Rather than dropping respondents who do not fall into a designated eight year historical period based on age, I extend the limits of the age cohorts, capturing all attitudes available in the sample.

³³ Tessler.

Six additional independent variables are also included in the regressions. For the purpose of control, gender (male coded as 1) is included in the regression. To test modernization theory, four variables are included: education level (no formal education through university, with degree), size of town (measured by population size, 0-2000 through greater than 500,000 inhabitants), interest in politics, and social trust. Lastly, satisfaction with financial situation of household (1 indicates low satisfaction and 10 indicates higher satisfaction). All variables are statistically significant in either one or both models. Lastly, A dummy variable (public sector =1) for sector of occupation is also included in the regression.

In model 1, the effect of age cohorts on the dependent variable – confidence in government – is examined. In the proceeding model, the dependent variable is support for democracy – importance of democracy, with the “confidence in government” variable introduced into the regression as an independent variable. This will allow us to examine the effect that government legitimacy has on demand for democracy.

Findings and Implications

Generation Effects

Table 1 presents the results of the regressions in which “confidence in the government” and “importance of democracy” are the dependent variables. Examined through the lens of generation effect theory, the relationship between generational cohort and confidence in government, and between generational cohort and support for democracy, reveals that Russian youth are not more inclined to be more supportive of democracy than previous generations. The findings contradict conventional wisdom that suggests that youth are inherently more progressive than their parents in terms of embracing democracy.

The table shows that confidence in government and support for democracy is only statistically significant related to cohort membership in one instance. Members of Brezhnev generation, or those coming of age during the height of the Cold War, are less likely to express confidence in the government and more likely to support democracy. This is likely due to the breakdown of guarantees offered under the Soviet system. For example, controlling for other factors, the Brezhnev generation is .092 units lower in predicted government legitimacy than the Putin cohort and the effect is statistically significant ($p < .05$). In other words, the cohort effect is only discernible in the case of the Brezhnev generation. Furthermore, the regression also shows that Russian youth take a neutral position with respect to support for democracy. Against that backdrop, though some democratic practices have been institutionalized, the fact that many fundamental institutions of the Soviet state had not changed may hinder demand for democracy.³⁴ The findings suggest that democracy is not in high demand among youth but not necessarily rejected.

Modernization Theory

When concerned with government legitimacy, in the form of confidence in the government, model 1 shows that government legitimacy is statistically related to two variables: social trust and interest in politics. Both are positively related to government legitimacy. The result from Model 1 shows that the perception of government performances presented by the main media outlets has

³⁴ Diuk, 8.

been positive, increasing confidence in the government. Speculation is informed by Diuk's findings which found that Russian youth gather nearly 90% of the news from the television.³⁵

Model 2 presents the relationship between support for democracy and modernization, controlling for generation and other independent variables. Importance of democracy is positively related to education level, size of town, and interest in politics (model 2). However, an inverse relationship exists between satisfaction with household-income and support for democracy. A one unit increase in education level and population density, support for democracy increases .1 and .08 on a scale of 1-10, respectively, when controlling for all other factors. The rise in national GDP could explain patterns of migration from rural areas to larger cities. In examining the effect of education, as education increases by one unit, predicted support for democracy increases .069, all else being equal ($p < .001$). Among Russian youth those who reported having some college-level education or obtained a college diploma were more likely to express a preference for a democratic political system. With recent reforms to primary education, only 17.7 percent of young Russians describe themselves as students in 2010, 3 degrees lower than 2003 levels.³⁶ With the decrease in secondary schooling and college enrollment, support for democracy may also decrease.

The information is consistent with previous studies examining the relationship between education and city size, suggesting that both variables are indicators of support for democracy. However, modernization theory weakens when considering satisfaction with the financial situation of the household. Those who positioned themselves higher on the scale are less likely to stress the importance of democracy.

Government Legitimacy

The results, in model 1, show that Russian youth express higher levels of confidence in the government than the Brezhnev age cohort. The positive perception of the Putin government, which is credited for the stabilization of the national economy, may be due to Russia's first experiment with democracy during the transition period. It is possible that Russian youth heard the horror stories of the "crazy 90s" and now draw a connection between a strong leader and a stable economy. As expected, size of town and education are not statistically related to confidence in government.

In model 2, Russians, who reported being satisfied with the financial situation of their household, were less likely to demand democracy. This demonstrates support for the status-quo in Russia. In other words, the turbulence of the late 1990s may be affecting demand for democracy. Additionally, for those who reported that they work in the public sector, predicted support for democracy decreased .22. The findings support an informed speculation about the connection between public sector employees and lower support for democracy, seeing that many fundamental institutions from the Soviet Union remain intact. While a negative relationship exists between satisfaction with financial situation and importance of democracy, the regression reveals a positive relationship between regime legitimacy and support for democracy. The more confident a respondent was in the government, the higher they position themselves on the importance of democracy scale. This is evident in model 2, as confidence in government increases by one unit, predicted support for democracy increases .24 on a scale of 1-10. This supports claims that positive perceptions of government effectiveness correlates with demand for democracy.

³⁵ Diuk, 13.

³⁶ Diuk, 2.

Conclusion

This present study presents evidence that, in contrast to conventional wisdom, age is not a strong predictor of support for democracy. The data shows that Russian youth do not hold more progressive views, with respect to democracy, than previous generations, specifically the Brezhnev generation. In model 1 and 2, generation effects are discernible in the attitudes of only one age cohort. In both instances, the respondents in the Brezhnev age cohort reflected attitudes that set them apart from other political generations.

The findings demonstrate how government performance, in form of higher confidence levels, has the potential to foster support for democracy in authoritarian regimes. While uncertainty remains as to whether Russian youth will continue to be ambivalent about democracy, government performance is likely to increase the demand for democracy if the regime is viewed as legitimate.

Since 2011, when the survey data was collected, the Russian people have been experiencing a defining period in their nation's contemporary history. Briefly, and most notably, Putin returned to presidency in 2012, further consolidating power, and is expected to remain in power until 2024. Domestically, the Putin administration has clamped down on civil society and independent news agency, passing more laws that restrict their activities. Abroad, Russia annexed the Crimean peninsula following the overthrow of the pro-Russian government in Kiev, Ukraine in 2013 and is suspected of providing military support to pro-Russian separatist. Additionally, with an approval rating in the 80 degrees, Putin's rhetoric has become aggressively reminiscent of the Soviet era rhetoric.

Additional research is needed to determine whether regime legitimacy/government performance will continue to have a positive impact on attitudes toward democracy. Furthermore, research is needed to test whether Russia's political culture is, perhaps, in organically, shifting towards authoritarianism, which is not tested for in this investigation. As the current regime expands its reach across the social space of civil society, additional attitudinal and behavioral data, specific to Russia, could potentially shed light on political, economic, and social beliefs and actions of Russian youth. Evidence of generation effects can plausibly emerge if emphasis is placed on other areas sociopolitical and economic life. This is essential to understanding whether regime legitimacy, the supply of democracy, will continue to lead to greater demand for democracy.

The focus of the study is to test for generation effects in attitudes towards democracy, as well as to introduce the government legitimacy variable. Although age alone does not explain variance (and only modestly in one case) in support for democracy, the analysis reveals that post-Soviet youth are moderate on support for democracy and government legitimacy, in the case of Russia, is positively related to support for democracy.

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Table 1	Model 1 (OLS) Confidence in Government	Model 2 (OLS) Importance of Democracy
Constant	2.113 (1 through 4)	5.736 (1 though 10)
Generation Effect Theory		
Generation Putin (<i>Cohort= 0</i>)		
Generation Gorbachev (=1)	-.015 (.049)	.090 (.168)
Brezhnev (=1)	-.092* (.046)	.361** (.157)
Khrushchev (=1)	-.087 (.065)	.207 (.222)
Modernization Theory		
Size of town	-.008 (.006)	.106*** (.022)
Education level	-.016 (.010)	.069*** (.033)
Social trust (<i>Trust= 1</i>)	.153*** (.038)	-.060 (.130)
Interest in politics	.068** (.022)	.233*** (.082)
Regime legitimacy		
Satisfaction with financial situation of household	.036*** (.007)	-.066*** (.026)
Sector of occupation (<i>Public= 1</i>)	.071** (.038)	-.215* (.129)
Regime legitimacy	N/A	.243*** (.081)
Gender (<i>Male= 1</i>)	-.061* (.035)	-.183 (.121)
Number of observations	1752	1659
R-square	.037	.036
Adjusted R-square	.032	.030

Note. – Standard errors are in parentheses; dummy variables are marked.

* Significant at the .10 level.

** Significant at the .05 level.

*** Significant at the .01 level.

Appendix

Generation effect

- Putin Generation (=0), Generation Gorbachev (=1), Brezhnev (=1), Krushchev (=1)

Modernization

- Highest level of education attained. No formal education [=1]/ Incomplete primary school [=2]/ Complete primary school [=3]/ Incomplete secondary school: technical type [=4]/ complete secondary school: technical type [=5]/ Incomplete secondary school: university-preparatory type [=6]/ Complete secondary school: university-preparatory type [=7]/ Some university-level education, without degree [=8]/ University-level education, with degree [=9]/
- Size of city. Eight-point scale, with "under 2,000 [=1]" at the lowest point and "500,000 or greater [=8]" at the highest.
- Social trust. "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? Most people can be trusted [=1]/ need to be very careful [=0]."
- Interest in politics. "How interested would you say you are in politics? Not at all interested [=1]/ not very interested [=2]/ somewhat interested [=3]/ very interested [=4]."

Government legitimacy

- Satisfaction with household income. "How satisfied are you with the financial situation of your household?" Ten-point scale, where 10 is the highest.
- Sector of occupation. Are you working for the government or public institution [=1], for private business or industry [=0], or for a private non-profit organization [=0]?
- Government legitimacy, independent variable for model 2. "How much confidence do you have in the government (in your nation's capital), parliament, and civil service? None at all [=1]/ not very much [=2]/ Quite a lot [=3]/ A great deal [=4]."

**Gene Expression Patterns of Bone Morphogenetic Proteins (BMPs) During
Early Embryonic Development in The Annual Killifish *Austrofundulus
Limnaeus***

By

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Faculty Mentor: Jason E. Podrabsky, Ph.D.

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Abstract

The developmental pattern of the annual killifish *Austrofundulus limnaeus* is unusual compared to other fish. First, the cell movements associated with gastrulation are separated from formation of the embryonic axis. In addition, embryonic diapause can occur. Diapause II and III are often observed when embryos are incubated at 25°C. Maternal influences and incubation environment are the factors that determine entrance into embryonic diapause, but the molecular mechanisms that regulate diapause are still unknown. Interestingly, embryonic diapause and the unusual cell movements observed during early development are always found together in species of annual killifish that exhibit diapause. Bone morphogenetic proteins (BMPs) are crucial in the development of various embryonic tissues. A recent study found the gene expressions pattern of BMP antagonists, noggin, chordin and follistatin, in early - embryonic development in *A. limnaeus* are different from zebrafish. This finding suggests BMPs may play roles in the regulation of diapause. In the present paper, the expression of BMP-2, BMP-4 and the BMP Receptor-2 were examined during early embryonic development in *A. limnaeus* using reverse transcription polymerase chain reaction (RT-PCR).

Keywords: *Austrofundulus Limnaeus*, gene expression, embryonic development, diapause, bone morphogenetic proteins (BMPs), BMP antagonists

Introduction

The analysis of hibernation and diapause among animals may provide information or shed light upon the fundamental cellular activities of multicellular organisms as well as how environmental conditions influence embryonic development in certain organisms. Annual killifish inhabit seasonal ponds in areas of Africa and South America. Several hundred species in this group rely on embryonic diapause to survive the drought season (Murphy and Collier, 1997). Diapause appears to have evolved separately on the two continents, Africa and South America. Amazingly, all annual killifish exhibit similar developmental stages, diapause I, II and III, where embryos can enter reversible metabolic and developmental arrest (Wourms, 1972a; Wourms, 1972b; Wourms, 1972c). This striking example of convergent evolution of embryonic diapause in annual killifish was possibly driven by their harsh habitat.

The annual killifish *Austrofundulus limnaeus* inhabits seasonal ponds in regions of northern Venezuela (Podrabsky et al., 1998; Hrbek et al., 2005). Compared to other teleosts, embryonic development of *A. limnaeus* is highly variable. Most embryos of this species can enter diapause II and III when reared in the lab and incubated at 25 °C in the dark. Only a small percentage of embryos escape diapause II and develop continuously and enter diapause III (Podrabsky and Hand, 1999). Both maternal influence and the incubation environment experienced by the embryo can determine if an embryo will enter diapause II. A higher proportion of escape embryos are produced by young females and incubation temperatures of 30°C favors development of escape embryos. The early produced embryos might have sufficient time to complete their lifecycle before the dry season, so it makes sense that young females produce more escape embryos than the old females (Podrabsky et al., 2010). Escape embryos follow a different developmental pathway— their anterior development is advanced compared to posterior development when compared with those entering diapause II (Podrabsky et al., 2010). This completely different form of early developmental plasticity within the same species is rarely observed in vertebrate embryos. Hence, the divergence in early development of *A. limnaeus* seems to be a novel phenomenon. The developmental trajectory in this system seems regulated by maternal influences, but it can be overridden by increasing the incubation temperature to 30°C (Podrabsky et al., 2010). Apart from the environmental insult that lead to metabolic arrest in *A. limnaeus*, recent research done in the Podrabsky lab has indicated that bone morphogenetic proteins (BMPs) may play critical roles in the regulation of diapause (Wagner and Podrabsky, 2015).

Like their name suggests, BMPs are important in bone and cartilage development. In addition, they also play crucial roles in the formation and differentiation of the nervous system in vertebrates (Liu and Niswander, 2005). BMPs are a group of multifunctional growth factors that belong to TGFβ protein family and are known to be important in vertebrate embryo development. Smad 1, 5 and 8 are the pivotal intracellular effectors of BMPs and they play crucial roles in BMP signal transduction. (Chen et al., 2004; Winnier et al., 2005; Nikaido et al., 1997; Larrain et al., 2000; Liu and Niswander, 2005; von der Hardt et al., 2007). BMP extracellular ligands bind to the BMP receptors (BMPRI and BMPRII), which belong to a family of transmembrane serine -threonine kinases, then phosphorylate receptor-activated Smad proteins (R-Smads). The activated R-Smad associates with common mediator (co-Smad) and then the complex enters the nucleus to regulate gene expression (Liu and Niswander, 2005). Noggin, chordin and follistatin are extracellular BMP antagonists (Wagner and Podrabsky, 2015), which bind directly to BMP ligands preventing them from binding with their cognate receptors and thus blocking the BMP signaling pathway (Liu and Niswander 2005). Mutations in BMPs and related genes affects the development of heart, neuron and cartilage in animals and humans (Chen et al., 2004). The correct formation of dorsal-ventral (DV) patterning in vertebrate embryos is controlled by signaling gradients of BMPs and their interaction with secreted BMP antagonists by the Spemann-Mangold Organizer (Wagner and Podrabsky, 2015).

A recent study in the expression of DV patterning genes during early development in *A. limnaeus* found that gene expression patterns of chordin and noggin-1 were different from zebrafish embryos. High expression of chordin and noggin-1 were detected in early cleavage stage embryos, right after fertilization, indicating maternally packaged chordin and noggin-1 may have unique function in early embryonic development in *A. limnaeus* (Wagner and Podrabsky 2015). Another study revealed three BMP genes in zebrafish (zBMPs) embryos, BMP-2a, BMP-2b and BMP-4, were expressed in 4, 8, 11, and 36 hours after fertilization (Martinez – Barbera, 1997). Human, mouse, *Xenopus*, and zebrafish BMP-2 and BMP-4 share a conserved sequence motif (Nikaido et al., 1997). BMP-2 may play a role in early embryo patterning and organogenesis in zebrafish (Nikaido et al., 1997). A comparison of zebrafish BMP-2 expression pattern with a fate map (Kimmel et al., 1990) showed zebrafish BMP-2 may act as a neural inhibitor, similar to *Xenopus* BMP-4 and *Drosophila* BMP (De Robertis and Sasai, 1996). Though the function of zBMP-4 is unknown, it can be deduced that zBMP-4 might have a similar role to anti-dorsalizing morphogenetic protein (Moos et al., 1995). Noggin is known to be a repressor of BMP-4 expression in the ventral marginal zone (Re'em-Kalma et al., 1995). Probably, noggin represses zBMP-2 expression in mesoderm (Nikaido et al. 1997). Therefore, it would be interesting to see the gene expressions of BMPs and BMP receptors in *A. limnaeus* embryos that will enter diapause compared to those that will not (called escape embryos), because the timing of development are different in these two groups of embryos (Podrabsky et al., 2010). In the present paper, four early - developmental stages (prior to diapause II) of *A. limnaeus* embryos were examined. Based on the above findings, it is possible to hypothesize that the gene expression of BMP-2 would be high right after early cleavage stage in *A. limnaeus* embryos while the gene expression of BMP-4 would be relatively low.

Materials and Methods

Husbandry of adult fish and treatment of embryos

Adult *Austrofundulus limnaeus* (Schultz 1949) were reared in the aquatic vertebrate facility at Portland State University. Embryos were collected 2 hours after mating. Randomly selected mating pairs of fish were allowed to deposit eggs into trays of glass beads (Thomas Scientific, Swedesboro, NJ, USA). Fertilized eggs were separated from unfertilized ones using a dissecting microscope by removing eggs without a clear perivitelline space. Fertilized eggs were transferred and incubated in a medium with similar ionic composition of their native ponds (0.0013 mM MgSO₄, 0.14 mM KCl, 0.8 mM CaCl₂, 2.14 mM MgCl₂, 10 mM NaCl). Methylene blue (0.001%) was added to the medium to help prevent fungal infections (Podrabsky et al., 1998; Podrabsky, 1999). The medium was changed daily for the duration of the experiment.

Embryonic Stages Examined

Four different early developmental stages of embryos were examined: early cleavage (1-4 hours post fertilization, hpf), high solid blastula (24 hpf), flat solid blastula (36 hpf), and 25% epiboly (48 hpf). For each stage, 4 replicates of 50 embryos were collected and placed into 2 ml microcentrifuge tubes (50 embryos for each tube). Embryos were then flash-frozen by submersion in liquid nitrogen and stored at -80 °C until RNA extractions were performed.

Isolation of Total RNA

TRIzol reagent (Life Technologies) was used to maintain RNA integrity during purification. Embryos were homogenized by the addition of 1 ml TRIzol directly into the 2 ml microcentrifuge tube that contained 50 frozen embryos, followed immediately by 20-30 sec of homogenization using an IKA Ultraturax dispersion homogenizer at the highest setting. Homogenates were kept at room

temperature for 10-15 minutes to allow complete dissociation of nucleoprotein complexes. Homogenates were subjected to centrifugation at 10,000 x g for 30 minutes at 4 °C. Supernatants were then transferred into fresh 2 ml microcentrifuge tubes (without cellular debris), followed by the addition of 200 µl of chloroform (200 µl chloroform / ml of Trizol). Then the mixtures were vortexed thoroughly before centrifugation again at 10,000 x g for 20 minutes at 4 °C. The top clear aqueous phase was transferred into a 1.5 ml microcentrifuge tube for RNA precipitation, which was performed by the "salting out" method of the addition of 250 µl 0.8 M sodium citrate and 1.2 sodium chloride, and 250 µl of 100 % isopropanol. Mixtures were vortexed thoroughly and stored at -20 °C overnight to allow RNA precipitation. On the next day, the RNA was pelleted by centrifugation at 10,000 x g for 30 minutes at 4 °C to maintain the integrity of the RNA pellet. Ethanol was removed and the pellets were allowed to air dry (10-15 minutes). RNA pellets were resuspended in 25 µl of 1 mM sodium citrate (pH = 6.4) followed by incubation at 55 °C for 5 minutes to aid in dissolving the RNA.

Qualification and Quantification of isolated total RNA

Sample concentrations and purities were determined by the measurement of absorbance at the wavelength of 260 nm (A260) and the ratio of A260/ A280 respectively. 2 µl of total RNA sample was placed carefully onto the quartz spot of a NanoQuant plate and which was immediately inserted into a microplate reader (infinite M200 pro plate reader) and analyzed by default software settings (i-control software, Tecan). The ratios of A260/A280 obtained from 16 samples were in between 1.36 to 2.15, and the sample concentrations were used to calculate the amount of samples that required to load in agarose gel-electrophoresis for the detection of total RNA integrity. Ethidium bromide was used as a fluorescent RNA stain and the staining intensity of the two major ribosomal RNA (rRNA) bands, 18S and 28S, represented the quality of total RNA. Four samples (one from each stage) with A260/A280 ratio from 1.55 to 2.15 and with intensive 18S and 28S rRNA bands were selected for reverse transcription (RT) and polymerase chain reaction (PCR).

Deoxyribonuclease (DNase) treatment and Reverse transcription (RT)

Prior to RT-PCR, genomic DNA contaminants must be removed from RNA samples. 15 µl of sample was transferred into a fresh 0.2 ml PCR tube and treated with 1 µl of 10X reaction buffer with MgCl₂, and 1 µl of DNase I, RNase-free (#EN0521)*. The mixtures were incubated at 37 °C for 30 minutes, followed by adding 1 µl of 50 mM EDTA and incubated again at 65 °C for 10 minutes. The treated total RNA was used as a template for reverse transcription to first strand cDNA. 10 µl sample was transferred into a fresh 0.2 ml PCR tube and mixed with 1 µl of Oligo (dT) 18 primers and 1 µl of random primers. The mixtures were centrifuged briefly before incubation at 65 °C for 5 minutes, and after incubation the samples were chilled on ice immediately. 4 µl of 5 X reaction buffer, 1 µl of RiboLock RNase inhibitor (20U/µl), 2 µl of 10 mM dNTP Mix, and 1 µl of RevertAid M-MuLVRT (200U/µl) were added in order then the mixtures were centrifuged briefly followed by incubation at 42 °C for 60 minutes and the reaction was terminated by incubation at 70 °C for 5 minutes.

Primer design and Polymerase Chain Reaction (PCR)

Gene specific primers to BMP-2, BMP-4, and BMP-2 were designed using PrimerQuest software (IDT) and gene sequences mined out of the recently assembled draft genome of *Austrofundulus limnaeus*. Primer sequences were confirmed as unique to the genes of interest by alignment to known nucleotide sequences in the NCBI Genbank nonredundant database using the BLAST

search tool. Pairs of primers (forward and reverse) were ordered from IDT. Primers were resuspended in TBE buffer as 100 μ M stocks were diluted to 10 μ M with dH₂O and stored at -20 °C for PCR.

The first strand cDNA obtained from RT was used directly in PCR. The sequences of primers used for PCR were: BMP-2 (forward), 5'- AAG GCC AGC ACG ATT AGA AG - 3'; BMP-2 (reverse), 5' - ATC CAG GTA GAG CAA GGA AAT G - 3'; BMP-4 (forward), 5' - GGT ACC TGA AGA AGG GAA GAA G -3'; BMP-4 (reverse), 5'- TGA CCG AAA GTA ACC AGA AGA G - 3'; BMPR-2 (forward), 5'- CAG AGT ACC AGA TGG CCT TTC -3'; BMPR-2 (reverse), 5'- CAG GTT CTT GTC CAC CTC TTT - 3'. PCR reactions were carried out in 50 μ l reactions containing 10x Taq buffer (5 μ l), 10mM dNTP's (1 μ l), DNase free H₂O (40.75 μ l) and Taq DNA polymerase (0.25 μ l). Thermal cycling was initiated by heating at 94 °C for 5 minutes to active polymerase and denature the DNA, followed by 40 cycles of denaturation at 94 °C for 20 seconds, annealing at 60 °C for 20 seconds, and elongation at 68 °C for 1 minute. The final products obtained from RT-PCR were analyzed using 1.2% agarose gel electrophoresis.

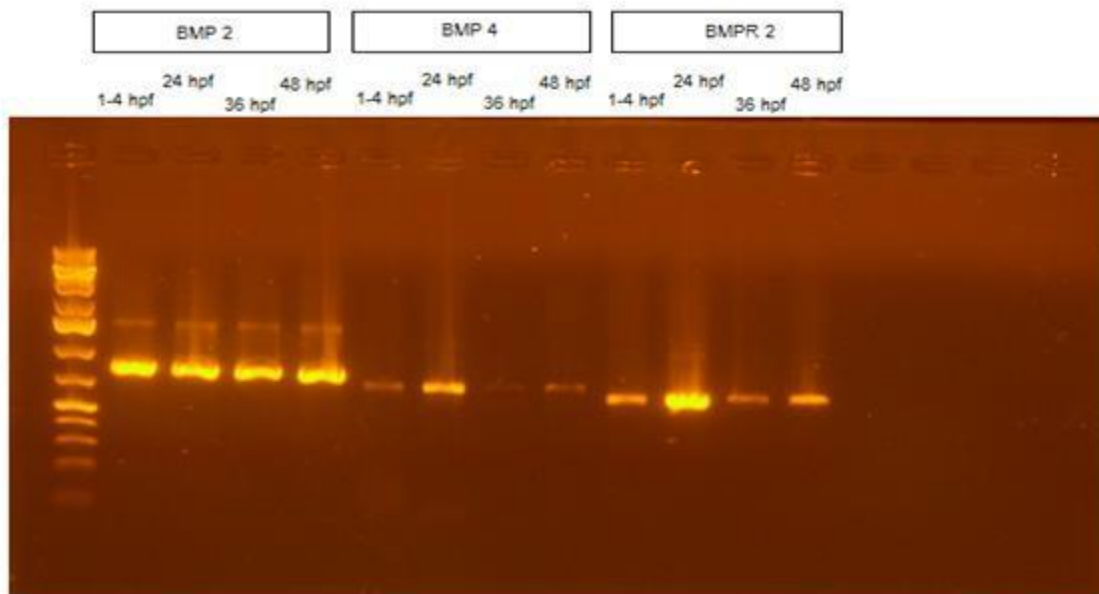


Figure 1. An agarose gel of RT-PCR products, BMP2, BMP4, and BMPR2, in four different developmental stages in *A. limnaeus* embryos. Size marker: 1kb plus DNA ladder: 20000, 10000, 7000, 5000, 4000, 3000, 2000, 1500, 1000, 700, 500, 400, 300, 200 and 75 bp from top to bottom. Amplicon length of BMP2 was 870 bp, BMP4 was 735 bp, and BMPR2 was 680 bp.

Results

Partial mRNA sequences of interest were amplified by RT- PCR and the results revealed the presence and differential expression of BMP-2, BMP-4 and BMPR-2 transcript at 1-4 hpf, 24 hpf, 36 hpf, and 48 hpf of *A. limnaeus* embryos. High BMP-2 expression was detected in all four stages. Compared to DNA ladder, four intensive bands appeared in between 700 to 1000 bp in the agarose gel analysis and the expected amplicon length of BMP-2 produced from RT-PCR was

870 bp (see Fig 1). In BMP-4 and BMPR-2, strong expression was detected in embryos at 24 hpf while relatively weak expression was detected in embryos at the other stages. The expected amplicon length of BMP-4 and BMPR-2 were 735 bp and 680 bp respectively. Four different intensity bands appeared at 700 bp in BMP-4, and in BMPR-2 the bands appeared right below 700 bp.

Discussion

BMPs play important roles in embryogenesis especially during early developmental stages. The concentration gradient of BMPs and BMP antagonists control correct dorsal-ventral patterning in *Xenopus* and zebrafish embryos (De Robertis and Kuroda, 2004; Zhang et al, 2007). BMP antagonists directly bind to BMPs preventing them from binding to their cognate receptors thus inhibit ventralizing activities (Kondo, 2007). Overexpression of BMP antagonists would cause dorsalization in zebrafish embryos (Kondo, 2007). The developmental patterns of annual killifish embryos are unique compared to other fish (Wourms, 1972a; Wourms, 1972b; Wourms, 1972c). Diapause II and III are frequently observed in the lab population of *A. limnaeus*, yet the underlying molecular mechanisms that regulate diapause is currently unknown. In zebrafish, RT-PCR detected the expressions of three BMP genes, BMP-2a, BMP-2b and BMP-4, in embryos at 4, 8, 11 and 36 hours after fertilization (Martinez-Barbera et al, 1997). In the present paper, the data obtained from RT-PCR also shown BMP-2 and BMP-4 were expressed in *A. limnaeus* embryos at 1-4 hpf, 24 hpf, 36 hpf and 48 hpf. Conversely, the gene expressions of BMP antagonists, noggin, chordin and follistatin, were not the same in *A. limnaeus* and zebrafish during development (Wagner and Podrabsky, 2015). The continued expression of chordin throughout early-embryonic development in *A. limnaeus* was in contrast to zebrafish (Wagner and Podrabsky, 2015). If the maternally packaged chordin and noggin mRNAs lead to expression of active proteins, then the findings above suggest that the extracellular gradients of free BMP-2 and BMP-4 signaling may be disrupted in early stages of *A. limnaeus* embryos compared to zebrafish, and this may contribute to the unusual developmental pathway in *A. limnaeus* embryos. Wholemount in situ hybridization can be used to further refine the mRNA expression of these genes in specific locations in *A. limnaeus* embryos. Also, further studies on other BMPs (BMP-1, -3, -5 and -7) and BMP receptors (BMPR-1a and BMPR-1b) may provide more information about the mechanisms by which BMP signaling control the unusual developmental pattern in *A. limnaeus* or if there is any relationship between diapause and the BMP signaling pathway.

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**Navigating Academia: A Mixed Methods Analysis of Sense of Community,
Student-Faculty Relationships and Student Success**

By

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Abstract

College enrollment in the United States is higher than it has ever been before. However, there is a strong delineation between students who know how to use education as a tool and students who do not. This study aims to understand the importance of sense of community and faculty-student relationships to student success and engagement. This cross-sectional study used quantitative and qualitative methodologies to examine sense of community and engagement in 210 undergraduate students. Sense of community, mentorship, university experiences, social intelligence, and demographic variables were analyzed using bivariate correlations, multiple linear regression, t-tests, and thematic content analysis. The research literature in this area supports the notion that higher social intelligence, sense of community and quality of mentoring relationships are all beneficial for long term success in academia and elsewhere; however, there is no published research to date that critically explores the relationship between these three phenomena. Results suggest that sense of community, mentorship, university experiences and social intelligence are important for academic success. Further, results highlight a difference in sense of community between transfer students and non-transfer students. This study suggests the need to examine these primary study variables in greater depth. These findings have ramifications throughout the fields of education and psychology because if we know what comprises the ability to use education as a tool, we can help others use this tool wisely to meet both professional and personal goals.

Keywords: Community Psychology, Social Psychology, Education

INTRODUCTION

Student enrollment in higher education is at an all-time high. Between 2002 and 2012, undergraduate enrollment rose 24 percent (U.S. Department of Education, 2015). Although more students are enrolling in college than ever before, they are still questioning whether or not it is a good investment (Psacharopoulos & Patrinos, 2004); and further, are feeling unsure as to how they can get the most out of their education. Explanations of student success are diverse and nuanced, but many researchers use the overarching meta-construct of student engagement (Fredricks, Blumenfeld, and Paris, 2004).

Student engagement is increasingly researched, theorized, and debated with a growing interest in measuring student outcomes (Zepke & Leach, 2010). Measuring student engagement is often suggested as a proxy for assessing the quality of education (Kuh, 2009), which is indicative of its critical role in educational outcomes. As theorized by Kahu (2013), student engagement has structural influences (e.g., university factors such as policies and culture; and student factors such as background and support), and psychosocial influences (e.g., university staff support, workload, relationships, student motivation, self-efficacy, and identity). Kahu (2013) also purported that student engagement has proximal consequences (i.e., achievement, learning, satisfaction, and well-being) and distal consequences (i.e., retention, work success, lifelong learning, citizenship, and personal growth). Using this conceptual framework, this study aims to better understand the student experience and to explore the structural and psychosocial influences of student engagement. The following sections will present the theoretical and empirical underpinnings of the primary study variables; articulate specific study aims and methods; and discuss the implications of findings for research and practice.

Sense of Community

Sense of Community (SOC) represents an overarching personal quality of strong attachment within a group. The psychological sense of community as a theoretical construct refers to "the importance of belonging to and being an integral part of a larger collectivity" (Townley et al., 2013, p. 279, Sarason, 1974). McMillan and Chavis (1986) define SOC as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (p. 9).

The following four components are fundamental to McMillan and Chavis' conceptualization of sense of community as an empirical framework: (a) *membership*, feelings of emotional safety with a sense of belonging and identification; (b) *influence*, exertion of one's self on the community with reciprocal impact of the community on oneself; (c) *integration and fulfillment of needs*, physical and psychological needs met, thereby reinforcing one to behave in a manner acceptable to the community; and (d) *shared emotional connection*, positive affect related to community membership (Pretty, Bishop, Fisher, & Sonn, 2006). The literature has shown that sense of community is related to active participation in community life (Chavis & Wandersman, 1990), subjective well-being (Prezza & Constantini, 1998), higher grade point average (Townley et al., 2013), and perceptions of belonging and connectedness (Sonn & Fisher, 1996). Most pertinent to students' SOC in higher education, McMillan & Chavis (1986) purported that membership to a group or community includes a "sense of belonging and identification... that one fits in the group and has a place there" (p. 10) as well as a "personal investment [which] will provide a feeling that one has earned a place in the group and that, as a consequence of this personal investment, membership will be more meaningful and valuable" (p. 10).

Sarason (1974) passionately claimed that the qualities inherent to sense of community are so important to human functioning that their absence may lead to isolation, loneliness, and depression, while further research supports that respondents with greater SOC report more

happiness, self-efficacy and coping strategies (Davidson & Cotter, 1991). With this in mind, it is critical to explore SOC in student populations. Many students, especially from diverse backgrounds report feeling “imposter syndrome” or rather, a feeling of fraudulence or that they do not belong in an educational or upper class setting due to their ethnic, racial or lower class background. Mack (2006) described this phenomenon as follows:

Although a college degree does increase the income of individuals, the educational experience should not be misrepresented as a free ride to upward mobility. Hidden beneath the seductive belief that education is the great equalizer is the assumption that being from the working class is a deficit or a liability... Marginalized students struggle to pass for the right kind of students, living in fear of being unmasked as undeserving (p. 54).

Perhaps it is this reason that women and racial minorities report a greater discrepancy between their actual and ideal sense of community (Townley et al., 2013). In order to create an equitable educational environment where students can use their education as a tool for upward mobility or to otherwise improve their lives, it is crucial to better understand how students cultivate a strong sense of community and form an academic identity.

University Environment and Mentoring

Similar to SOC, University Environment is a concept that represents the degree to which students feel welcome in the university environment and the impact of institutional factors (e.g., class size, perceptions of faculty, etc.) on their experiences. Research shows that higher scores on the University Environment scale are related to greater comfort within the institution, a willingness to seek out help (Gloria, Hird, & Navarro, 2001), and academic persistence (i.e., whether or not students continue on from term to term and follow through to graduation) (Castillo et al., 2006).

Further, mentorship plays a significant role in the academic experience of students because of the discipline-specific apprenticeship model that higher education follows. Nora and Crisp (2007) proposed a theoretical framework comprising the latent functions of mentoring; these include: (a) *psychological and emotional support*, cultivating a supportive relationship with encouragement, help identifying problems, and both moral and emotional support; (b) *degree and career support*, assessment of goals and help with decision-making; (c) *academic subject knowledge support*, acquisition of specific knowledge and skills while also learning conventions and norms of a specific field; (d) and the *existence of a role model*, having someone to model appropriate behavior, and to learn from current or past successes and failures. In addition to the latent benefits, there are also manifest or tangible benefits, such as letters of recommendations or access to education/career-related information that they were not likely to have received otherwise (Freeman, 1999). Moreover, there are social-psychological theoretical underpinnings of mentorship that are worthy of note. Just the mere fact of having a mentor aids in identity development and formation, especially that of a professional or academic identity. Leading impression management researcher Barry Schlenker (1994) articulated it best when he said “it’s because when people act in certain ways, and someone is watching, they become obligated to show some consistency in their personalities” (p. 21). Finally, mentorship has been linked to greater self-efficacy among students and increased confidence in their ability to make decisions, problem-solve, and achieve goals (Cosgrove, 1986).

Social Intelligence

Finally, social intelligence refers to the ability to adapt to, shape, and select everyday environments (Sternberg, 2000). Bourdieu (2005) adds that habitus, another term for social intelligence, is an internalized understanding of reality, as well as habits of dispositions to act, think, and feel in

certain ways learned from one's social or cultural environment. Sternberg refers to social intelligence as "practical intelligence" and claims that social intelligence is situational and contextual, which is why this study employs the use of social intelligence in a higher education setting. Researchers have found that the most crucial components of any social intelligence are: (a) an extensive knowledge of rules and norms in human relations; (b) having developed effective interpersonal skills; (c) understanding and taking on the perspective of other people; (d) adapting well in social situations and being open to new experiences, ideas, and values; (e) and, being warm and caring (Kelly, 2010; Kosmitzki & John, 1993).

According to a study conducted by Thomas (2002), student success was mediated by their ability to adapt to the social climate of the institution; and, therefore, certain groups of students were more likely to perform better if they came from a majority, or dominant, social group. Specifically, if students feel that they do not fit in, or that their social and cultural practices are inappropriate or undervalued, they may experience negative academic and personal outcomes compared to students from dominant social groups (Bourdieu & Wacquant, 1992; Thomas, 2002). It is for this reason that understanding student engagement and sense of community inherently includes whether or not a student knows how to navigate the social environment of the university. Having little knowledge of or background with a set of rules, norms and values would put a student in a more precarious position when navigating the university system, and this study aims to understand if this impacts sense of community, student-faculty relationships, and grade point average.

Study Aims

As indicated by the review above, the overarching goal of this study is to better understand the influence of SOC, student-faculty relationships, and social intelligence on the academic experiences of undergraduate students. The specific aims of the study are as follows: (a) to investigate potential differences of SOC across student variation and demographic groups; (b) to examine how university experiences, mentorship and social intelligence affect SOC; (c) to assess the relationship between primary study variables and grade point average; and, (d) to explore the importance that SOC plays in a student's academic experience.

METHODS

Participants

The sample for the quantitative component of this study consists of 210 undergraduate students enrolled in courses at Portland State University. Of the 210 participants, 144 (72%) were female, 49 (24.5%) were male, and 7 (3.3%) identified as either transgender or gender non-binary. The racial composition of the sample was as follows: 130 (65%) were White, 4 (2%) were Black, 17 (8.5%) were Latino, 19 (9.5%) were Asian American, one (.5%) was Native American, one (.5%) was Hawaiian/other Pacific Islander, five (2.5%) reported "Other" race/ethnicity, and 23 (11.5%) reported being multiracial. Of the 210 participants, 116 (57.1%) were transfer students and 85 (42.5%) were first generation students. Additionally, 174 (87%) of respondents live off campus and 22 (11%) respondents reported living in University residential housing. The qualitative portion of the study consists of 16 undergraduate students at Portland State whose demographics were comparable to the general study sample.

Procedures

Students were recruited from classes taught at Portland State University. Informational emails were sent out to professors through departmental listservs and personal email in the University

Studies department, the Honors department and the Philosophy department. Emails were also sent to Capstone faculty, Psychology faculty, and Sociology faculty. Professors were given the option of offering extra credit for student participation in the online survey. Completion of the survey was both anonymous and voluntary. As per Institutional Review Board approval, there was approximately a three-month window for data collection. Completion of surveys was tracked throughout data collection using an online survey platform. A gift card was offered to one student at random to incentivize students' participation.

Students who participated in the online survey could indicate that they would like to be contacted to participate in the focus group portion of the study. Randomly selected students were then contacted and offered three time slots to participate in the focus group. Focus group participation was voluntary but not anonymous or confidential because of the nature of focus groups. Gift cards were offered to incentivize students' participation.

Measures

SOC. Sense of Community was measured via the 24-item Sense of Community Index 2 (SCI-2; Chavis, Lee, & Acosta, 2008). Participants responded to 24 items assessing perceptions of community membership, influence, fulfillment of needs, and shared emotional connection. SCI-2 items were rated on a 4-point scale, ranging from 1 (*not at all*) to 5 (*completely*). Minor modifications were made to several SCI items to reflect the context of this study sample (i.e., changing the word "community" to "university"). The SCI-2 has demonstrated strong reliability and validity (Chavis et al., 2008). The Cronbach alpha for the scale in this sample was .95. Sum scores (created by adding the 24 scale items) ranged from 24 to 96 ($M=53.8$, $SD=14.4$).

Student-Faculty Relationships. Student-Faculty Relationships were measured using the 25-item College Mentoring Scale (CMS; Lin, M. M., 2011). These items include four interrelated latent variables: psychological and emotional support, degree and career support, academic subject knowledge support, and the existence of a role model. CMS items were rated on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Several studies show empirical support for the CMS (e.g., Gloria, 1993; Lin, M.M., 2011; Nora & Crisp, 2007). The Cronbach alpha for the scale in this sample was .97. Sum scores (created by adding the 25 scale items) ranged from 25 to 120. ($M=80.8$, $SD=21.6$).

University Environment. University Environment, or rather the extent to which students feel welcome in the university environment, was measured using the 14-item University Environment Scale (UES; Gloria & Robinson Kurpius, 1994). UES items were rated on a 4-point scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). A number of studies have demonstrated the UES' construct validity and, more notably, its validity and applicability to students from diverse racial and SES groups (e.g., Castillo et al., 2006; Gloria et al., 1999, 2001, 2003). The Cronbach alpha for the scale in this sample was .80. Sum scores (created by adding the 14 scale items) ranged from 14 to 56. ($M=37.8$, $SD=3.6$).

Social Intelligence. Social Intelligence, or rather a student's practical intelligence in the university environment, was measured using the 33-item Test of Social Intelligence in the College Classroom (Kelly, A.E., 2010). Test of Social Intelligence items are questions regarding features or scenarios in a college setting. Sample questions include "How much training does a professor typically get on how to teach?" and "What does a typical professor at a major university do in the summer?". Respondents choose an answer from a series of multiple choice options where there is a correct answer. For this reason, a Cronbach alpha score or other score of internal consistency is inappropriate (Bland & Altman, 1997). Although there is little psychometric information published for this new measure, it was developed specifically for the university environment and modeled after what research shows to be the essential features social intelligence as a construct (Kosmitzki

& John, 1993). Sum scores (created by adding the correct responses from the 33 scale items) ranged from 4 to 25 ($M=15.3$, $SD=3.7$).

Academic Outcomes. This study used self-reported grade point average (GPA) as an additional outcome variable evaluating student success and engagement. GPA's ranged from 1.65 to 4.0 ($M=3.39$, $SD=.45$)

Data Analysis

Individuals who were missing the majority of data on two or more scales included in the regression model were deleted from the dataset. For cases in which individuals were missing less than 10% of items within a scale, person mean imputation - which calculates the mean across each person's available item responses and imputes this mean for each missing value for that particular person - was used. This approach has been recommended in the literature (e.g., Bernaards & Sijtsma, 2000).

The influence of University Environment, Mentoring, Social Intelligence and demographic variables on Sense of Community was assessed using a multiple linear regression using two blocks. The first block included age, gender, race, and transfer status; and the second block included the scale score for University Environment, Mentoring and Social Intelligence. A correlation matrix was employed to examine the relationship between Sense of Community, Social Intelligence, Mentoring, University Environment and GPA. Independent samples *t*-tests examined potential differences in Sense of Community of racial groups, gender, transfer status and whether or not the student lived on campus.

For the qualitative component of this study, focus group interviews were transcribed verbatim and analyzed using thematic content analysis. Specifically, transcripts were analyzed for student perceptions of and experiences with the primary study variables (e.g., Sense of Community and Mentoring). Illustrative quotes are presented to highlight central thematic categories discussed by participants.

RESULTS

A multiple linear regression analysis was conducted, regressing Sense of Community on demographic variables, Mentoring, University Environment and Social Intelligence. Table 1 below provides the results of this analysis. Together, Mentoring, University Environment and Social Intelligence accounted for a significant proportion of variance in respondents SOC, $R^2 = .34$, $F(3,210) = 12.17$, $p < .01$. Controlling for demographic variables, Mentoring was positively related to SOC, $B = .33$, $t(210) = 8.3$, $p < .01$. Furthermore, University Environment was positively related to SOC, $B = 1.06$, $t(210) = 3.7$, $p < .01$. In contrast, Social Intelligence was not significantly related to SOC when controlling for demographic variables, $B = .09$, $t(210) = .38$, $p = .72$. The only demographic variable that significantly predicted SOC was transfer status, $B = 4.23$, $t(210) = 2.2$, $p < .05$, which is discussed in more detail below.]

Table 1

Results of a Multiple Linear Regression of Demographic Variables, Mentoring, University Experiences and Social Intelligence on Sense of Community

	<i>B</i>	<i>SE(B)</i>	<i>t</i>
Intercept	-17.02	12.09	-1.41
Race	-.66	1.81	-.37

Gender	-3.40	1.94	-1.76
Age	.09	.14	.64
Transfer Status	4.23	1.95	2.16*
Mentoring	.33	.04	8.28**
University Environment	1.06	.29	3.67**
Social Intelligence	.09	.23	.38

Notes: * $p < .05$, ** $p < .01$. $N = 210$. Model $R^2 = .34$, $F(3,210) = 12.17$, $p < .01$.

A correlational analysis was conducted to estimate the association between University Experiences, Social Intelligence, Sense of Community, Mentoring and GPA (See Table 2). The correlation between SOC and Mentoring is positive and significant ($r = .53$, $p < .01$). There was also a moderate, positive correlation between SOC and University Environment ($r = .21$, $p < .01$). Social Intelligence was moderately, positively correlated with Mentoring ($r = .18$, $p < .05$) and positively correlated with GPA ($r = .21$, $p < .01$). Mentoring was also positively correlated with GPA ($r = .21$, $p < .01$).

Table 2

Results of a Correlation Matrix of University Experiences, Mentoring, Social Intelligence and Sense of Community on Grade Point Average.

	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.
1. SOC	53.8	14.4	1	.11	.53* *	.21**	.08
2. Social Intelligence	15.3	3.7	.11	1	.18*	-.03	.21**
3. Mentoring	80.8	21.6	.53**	.18*	1	.02	.21**
4. University Environment	37.8	3.6	.21**	-.03	.02	1	-.001
5. GPA	3.39	.45	.08	.21**	.21* *	-.001	1

Notes: $N = 210$. * $p < .05$, ** $p < .01$.

An independent-samples t -test was conducted to evaluate whether or not transfer students and non-transfer students' SOC scores differed. Mean SOC index scores for transfer students ($M = 51.6$, $SD = 12.03$) were significantly lower than the mean SOC index scores for non-transfer students ($M = 56.14$, $SD = 15.89$), $t(210) = -2.29$, $p < .005$, $d = -.32$. Figure 1 shows a graphical display of the results. The results indicate that non-transfer students reported a higher Sense of Community than transfer students. There were no statistically significant mean differences between other demographic groups (i.e., age, gender, race, on campus housed vs. off campus housed).

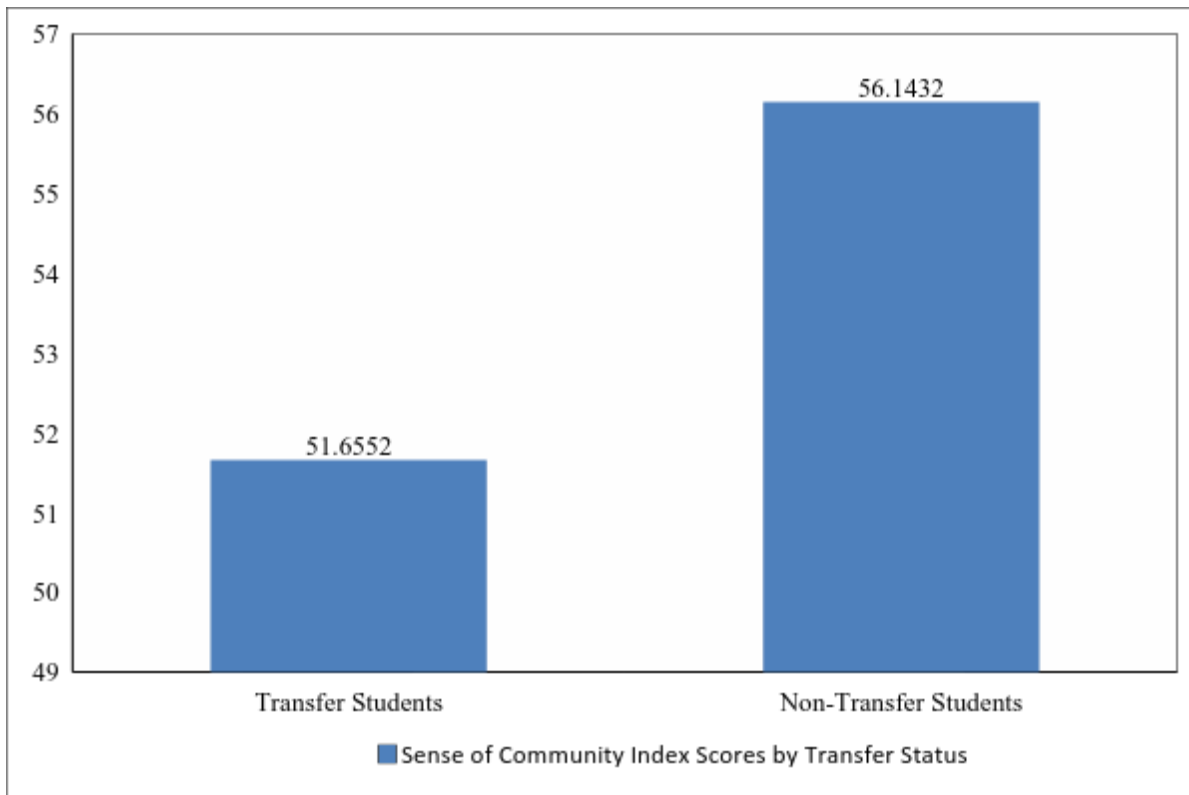


Figure 1. Mean Sense of Community Scores of Transfer and Non-Transfer Students

Qualitative Results

Findings from the qualitative component of this study help to contextualize the quantitative results presented above. For example, when asked to reflect on the role that Sense of Community plays in their lives, one respondent said the following:

I think it depends on the community. Um, but at least from my side, it usually is a bettering thing. I like being around people that can teach me things. I can learn from [them] as well as share a common interest and common passions, so usually part of the community is being able to um, learn from each other. Not necessarily even academically, just in general... in life. Being able to kind of sculpt my identity based on the types of things that I learn, no matter what they are.

Many focus group respondents agreed that a large function of community and belonging to them was emotional support and an increased well-being. One respondent claimed that, "It's definitely emotional support. Because I mean, a few people have mentioned just how lonely it can be."

Another participant echoed this sentiment:

[It's important for me to] especially on an emotional level, like reach out and communicate. [If I don't have that support] I have a tendency, it like, really affects my well-being. So in order to do that, you need to have people and in that way, it's highly important for me to have a community of some sort.

Most students maintained that they did not identify with the overall school community but had their needs of membership, influence, integration and fulfillment of needs, and shared emotional connection met through niche communities. The vast majority of focus group participants expressed the importance of niche communities and especially for discipline specific communities as essential to their SOC and academic engagement. One participant said,

I think subject-specific communities are really important. I mean, for me, I have my group of friends who are from all over. My friends are Computer Science and Women's Studies and, you know, the whole laundry list. But, more than half of them could give a crap about my interests, and trying to have some of those conversations can be really difficult and isolating... um, so it is nice to have those kinds of friends that kind of share that same passion and have a similar knowledge base.

Participants expressed that their personal investment to the discipline or subject aided in their sense of belonging and feeling that they had earned their place in the group. However, when asked about the effects of a lack of sense of community, respondents supported notions of loneliness, isolation and a decreased sense of well-being. One respondent said the following:

In general, I feel completely anonymous here... It's really difficult because I come from a really small town... so, being anonymous was really bizarre to me at first. There's a lot of freedom involved, like people don't have expectations of me, really. Like my classrooms are really large, my teachers don't know who I am... You know, I was a scantron... So um, yeah, I hold myself to my own performance standards. But, it's kind of weird. It's weird like sitting and eating lunch and not knowing anyone.

Additionally, focus group participants spoke to the redeeming qualities of having a mentor when their SOC or sense of belonging was low. One student said, "Not having a community disconnects me from it a little bit, so having someone kind of 'in my corner' in some sense is really vital to me." Participants also remarked about the importance of getting along interpersonally with a mentor in order to cultivate a strong professional relationship. Common attributes that most participants noted as important for a successful student-faculty relationship were having similar communication styles; perceiving the mentor to have unconditional positive regard. For instance, one student reported,

"I think the best part about that relationship is just how encouraging she is. I never come to her with an idea and she's like 'Oh, I don't know if you should do that' or 'Maybe you should do it like this...' It's always like, 'Yeah! Do whatever! Make it happen!'"

Other common attributes reported in the focus groups were the common interests and cultivation of their autonomy as scholars. For example, one respondent said the following:

For me it was like similar drives and work ethics. I choose mentors that push me; they don't just give me the answer. They kind of hint at what they want; but then if I do all of the legwork for them, they show me the appreciation and the reward. I've had to go out of my way for my faculty, and it makes me work harder.

Students also articulated the importance of their mentor being responsive and warm, and essential for role performance and modeling behavior, for example, "They help to model behavior in showing me that 'Oh, I can totally be myself and still kind of find my niche and still kind of, I don't know, find my adulthood and professionalism.'"

Furthermore, many students reported the importance of having a reciprocal relationship where both parties are putting in time and energy and obtaining tangible benefits. Some of the latent benefits supported by the focus group findings were emotional support, practical support/advice, the teaching of skills or discipline specific social capital, as well as impression management. The manifest functions supported by focus group findings were letters of recommendation, information about important opportunities, networking connections, etc.

Respondents cited institutional factors (e.g., large classes, adjunct faculty being spread too thin, advisors having overly large workloads) as primary reasons for not seeking out or cultivating student-faculty relationships. One student said that their professor "...didn't care about the development of the student. He cared about- he just kind of showed up to class because he had to... [that was] the worst experience and [I felt] like I was paying this person to not-to care less."

Another respondent said “I wonder how much of that is just, they don’t have enough time to even devote, like the bandwidth to deal with that many people.”

Students also cited individual reasons, such as a general unawareness that it was important to have a mentor and perceiving their professors as being cold, distant, and unavailable. The most salient reason expressed for not connecting with faculty was that the instructors were non-inclusive, prejudiced, unprofessional, or disorganized. For example, one student said

He would make racist and sexist remarks. And I lost all respect for the guy immediately.... Like, no we can’t totally, overnight, bridge the gap and like pay magical reparations and suddenly have a mixed race, mixed gender demographic represented in the faculty because change doesn’t happen overnight like that- and it wouldn’t be sustainable if we forced it, you know....But yeah, to see [institutionalized and systemic oppression] reinforced by people in mentorship positions is pretty infuriating.

DISCUSSION

The current study has important implications for future research and practice in community psychology, social psychology, and higher education. To our knowledge, this is the first study of its kind to employ mixed methods to investigate the relationship between SOC, student-faculty relationships, university environment and social intelligence. Analyses revealed that mentoring (student-faculty relationships), university environment, and transfer status were most predictive of sense of community. It makes conceptual sense that if a student feels comfortable in their environment, they are more likely to feel a sense of belonging because these two phenomena intuitively go together. Similarly, the notion that mentorship aids in the development of SOC is theoretically consistent. If a mentor is accepting and provides support, this would increase a student’s sense of belonging as well as the development of specialized skills, knowledge, social intelligence and role performance that would also make a student more likely to fit in and belong.

Further, results suggest that mentoring and university environment are most closely correlated with SOC; social intelligence is most correlated with student-faculty relationships and GPA; and mentoring is also correlated with GPA. These results highlight how critical mentorship is for a student’s sense of community, social intelligence and GPA. The relationship between social intelligence and GPA is one that has a lot of face validity. If students are better at learning the rules and norms of the cultural practices required of university students, they are more likely to engage with course material, classmates, and professors in a way that their instructor intended; which would elicit higher grades and evaluations of performance and mastery. These findings support the use of an apprenticeship model of academia and are consistent with social intelligence theories outlined in the literature.

We found that transfer students reported higher sense of community than non-transfer students, which is consistent with previous research reporting a decrease in SOC among transfer students (Townley et al., 2013). Contrary to past research, however, our results did not indicate any statistically significant differences in mean SOC scores across demographic groups (i.e., age, gender, race, on campus housed vs. off campus housed). This may be due in part to the homogenous nature of our sample (i.e., participants were primarily White, female, younger), as will be discussed in more detail below.

Limitations and Suggestions for Future Research

Several study limitations are worth noting. First, the small sample size and homogeneity of the sample must be recognized. Although the sample size was large enough to detect significant

relationships between primary study variables and SOC, there may have been insufficient power to detect other potential associations. Further, the sample lacked diversity in race/ethnicity, gender, sexual orientation, and geographic location. Thus, we are missing the experiences of students who may be engaging with their community and academia differently than the students included in the current study. A future study should collect data from a larger number of participants who are more representative of the demographic composition of the population. Further, a study including different geographic locations as well as different types of institutions would increase the generalizability of study findings and enrich the literature on the cultural differences and institutional factors impacting sense of community, engagement, and student success. Making these changes would increase both the variability of results and diversity of experience, while also increasing the likelihood of detecting relationships that plausibly exist in the real world.

Second, causation cannot be inferred from the results of this study's cross-sectional design. The main limitation with this design is that there is no indication of chronological order of the primary study variables. It is not clear how and when students increase their social intelligence, cultivate mentoring relationships, form perceptions of their university environments, and develop a sense of community. Further, it is not clear from the current study how these phenomena affect one another over time. To address these issues, a future study should record students' experiences over a course of time. A longitudinal study design would facilitate better understanding of how these variables interact over time and across different settings and demographics.

Moreover, this study used self-report measures. Particularly, mentorship and GPA are susceptible to self-report biases such as the social desirability effect. It would be helpful in future research to obtain GPA from institutional records as well as additional data collected directly from mentors to triangulate student reports. Additionally, the current study took a community psychological (i.e., contextualist) approach rather than an individualistic approach and therefore did not include measures such as individual motivation, academic persistence, and other psychological characteristics that may account for additional variance in outcomes.

Finally, the Social Intelligence scale lacked empirical validation and psychometric information. While this measure did yield significant results, a future study should focus on assessing the psychometric characteristics of this scale.

Conclusions and Practical Implications

Navigating higher education is often an arduous and tumultuous experience that may be more difficult for certain kinds of students. Results of the current study highlight the importance of a contextualized, holistic understanding of students' sense of community and mentoring relationships. We found that student-faculty relationships were most strongly related to and predictive of higher sense of community, GPA, and social intelligence. These findings emphasize the importance of creating opportunities for students to cultivate mentoring relationships. Additionally, we found that transfer students had a lower sense of community than non-transfer students, which brings attention to the need to better integrate students into their post-transfer institutions. Indeed, strong supportive mentoring relationships may be most critical for transfer students. Similarly, qualitative results suggest the importance of developing sub-communities (e.g., discipline-specific student groups) within the larger campus community, as these may help to combat feelings of isolation and loneliness experienced by many students. When assessing outcomes in higher education, it is important to prioritize students' emotional and social engagement as well as institutional and environmental factors as key indicators of their academic success.

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Prevalence and Use of Guns in Perpetration of Intimate Partner Violence

By

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Abstract

Intimate partner violence (IPV) is a social problem and public health issue in the United States that various states and the federal government have taken special precautions to alleviate. Two studies were conducted to address the problem. Study 1 examined archival data from a study that administered the Revised Conflict Tactic Scale to students taking psychology courses at Portland State University. The majority of students within the sample perpetrated psychological aggression but not physical assault. It was inconclusive whether more male than female college students perpetrated in physical assault against their partners. Lastly, less than 1% of students had ever physically assaulted their partner using a weapon. In study 2, using research from scientific literature databases, I conducted a review of studies that examined whether there is a difference in the prevalence of IPV perpetration between people who possess a firearm and those who do not, as well as whether gun repossession laws have proven to be effective in reducing IPV. The review yielded mixed findings for both questions. There is a consensus that gun confiscation laws are effective at preventing IPV among people with restraining orders, but not those with domestic violence misdemeanor convictions. Implications for both studies of social policy and future research on use of guns in perpetrating IPV are discussed.

Keywords: Intimate Partner Violence, Gun Violence, Intimate Partner Homicide, Gun Law Efficacy

Introduction

Intimate partner violence (IPV) is a social problem and public health issue we are facing worldwide, with about 1 in 4 females in the United States and 1 in 7 males in the United States reporting a lifetime prevalence of IPV victimization, as of 2005 (Breiding, Black, & Ryan, 2008). For the purposes of this research, IPV is defined as "physical violence, sexual violence, stalking and psychological aggression (including coercive acts) by a current or former intimate partner. This type of violence can occur among heterosexual or same-sex couples and does not require sexual intimacy" (Breiding, Basile, Smith, Black, & Mahendra, 2015). It is important to note that this type of violence includes both homicidal and non-homicidal acts.

In order to address this problem, the first step is to gain an understanding of the prevalence of IPV and how it is perpetrated. Researchers have done so in various ways, such as the creation of the Revised Conflict Tactic Scale, which has people self-report personal perpetration and victimization of the various forms of IPV (Straus, Hamby, Boney-McCoy & Sugarman, 1996). Additionally, there are federal reports that disclose the yearly rates of intimate partner homicides. These homicides typically involve gun or other weapon usage and help inform the relationship between IPV and gun violence. These steps have been successful at understanding the extent of the problem in various environments. Using this knowledge, policy makers and community based workers could then implement laws that reduce likelihood of both perpetration and victimization of IPV. Legislators have attempted to do so over the past 20 years, such as through the implementation of gun restrictions for known perpetrators of IPV and domestic violence. The success of these efforts is still under investigation.

To better inform such efforts I conducted two research studies. The first study aims to contribute to the knowledge about the prevalence of IPV among university students. By looking at rates of perpetration of physical assault and psychological aggression by students at Portland State University against their intimate partners, we can understand the extent to which various kinds of IPV are committed. Additionally, looking into whether there is a difference in rates of perpetration of physical assault by men and women, we can gain insight into whether gender may serve as a predictor of IPV perpetration, as this has been found in previous studies. Another issue examined was the prevalence of physical assault perpetration with the use of a weapon, which may help us further understand the extent to which these specific acts involve weapons. The second study examined the extent to which weapons are used in IPV perpetration in the general population. I evaluated efforts to reduce this usage by conducting a literature review of state and federal gun law repossession efficacy. Together, findings from both studies may yield implications for legislative policies to address use of weapons in the perpetration of IPV.

Study 1

IPV is prominent among college students, with 85.4% of women and 55.0% of men reporting perpetration of sexual, emotional and/or physical violence against their partners in one particularly well-conducted study (Forke, Myers, Catallozzi, & Schwarz, 2008). However, people tend to overlook the fact that IPV can involve more than just physical violence. Developers of the Revised Conflict Tactic Scale (Straus, Hamby, Boney-McCoy & Sugarman, 1996) identified five categories of IPV: psychological aggression, physical assault, injury, negotiation and sexual coercion. Realizing and acknowledging that IPV can be defined as such a broad range of unhealthy actions, we can spread awareness and create more healthy relationships among college students. To better address questions about this range of forms of IPV in college students and to determine the prevalence of weapon use in perpetration of IPV, I conducted a study to address the following questions and hypotheses:

Research Question 1. Is psychological aggression more prevalent than physical assault against intimate partners among college students?

Hypothesis 1. Because psychological aggression may predict future perpetration of physical assault (Murphy & O'Leary, 1989), I hypothesize that psychological aggression is more prevalent than physical assault against intimate partners among college students.

Research Question 2. Do more male than female college students commit physical assault against their intimate partners?

Hypothesis 2. Because past studies have generally found that men are more likely to perpetrate multiple forms of IPV than women (Hamby & Sugarman, 1999), I hypothesize that more male than female college students commit physical assault against their intimate partners.

Research Question 3. What is the prevalence of weapon use in assaults against intimate partners among college students?

Methods

Participants

The participants in the study were students at Portland State University who were enrolled in one of fourteen different psychology classes in the summer of 2006. Out of 556 eligible participants, 547 filled out the survey during their psychology course, but 14 were missing data, so the analysis consisted of 533 completed surveys. Of the respondents ($n=533$), 138 (25.9%) were male, 392 (73.5%) were female, and 3 (0.6%) preferred to not answer the questions about gender. The age of respondents ranged from 17 to 59, with an average age of 24.4 and standard deviation of 7.6. Lastly, 195 (36.6%) were single at the time of the survey, 191 (35.8%) were single but in a relationship, 116 (21.8%) were living as married or married, 4 (0.8%) were separated, 8 (1.5%) were divorced, 11 (2.1%) identified as other and 8 (1.5%) preferred to not answer.

Measures

To address the hypotheses, I analyzed archival survey data that had been collected by my adviser and his former students. The Human Subject Review Committee at Portland State University had approved this study. The study relied upon data from a self-report survey, the Revised Conflict Tactic Scale (CTS-2), which consists of 78 questions divided into five subscales: psychological aggression, physical assault, injury, negotiation, and sexual coercion. For my study, the subscales I focused on were psychological aggression and physical assault. Examples of questions for the psychological aggression subscale included: "I accused my partner of being a lousy lover" and "I insulted or swore at my partner." Examples of questions for the physical assault subscale included: "I kicked, bit, or punched my partner" and "I slammed my partner against the wall" (Straus, Hamby, Boney-McCoy & Sugarman, 1996). Participants were asked to report how many times a specific event occurred in the past six months. They were given eight response options: never happened, once in the past six months, twice in the past six months, three to five times in the past six months, six to ten times in the past six months, eleven to twenty times in the past six months, over twenty times in the past six months, and not in past six months but it has happened before. All responses that indicated one or more instances of perpetration were combined and coded as a 1, whereas all responses that indicated no instances of perpetration were coded as a 0. The reliability and validity of the instrument are well-documented by other scholars (Straus et al., 1996).

Analysis

For all analyses, I used the Statistical Package for the Social Sciences version 22.

To address the first research question, I used a McNemar test because I was comparing the prevalence of two dependent variables in one sample, psychological aggression and physical assault perpetration by college students. For the second research question, I used a chi square test because I was comparing the prevalence of a single variable in two different samples, physical assault perpetration by males versus physical assault perpetration by females. For the third research question, I used a descriptive frequency analysis because I wanted to compute how many respondents reported at least one perpetration of physical assault with a weapon against their intimate partners.

Results

Hypothesis 1

When comparing prevalence rates of psychological aggression to prevalence rates of physical assault in of a sample of college students ($n=533$): 197 (37%) did not report a single occurrence of psychological aggression or physical assault, 224 (42%) reported at least one occurrence of psychological aggression but no occurrences of physical assault, nine (1.7%) reported at least one occurrence of physical assault but no occurrences of psychological aggression, and 103 (19.3%) reported at least one occurrence of physical assault and at least one occurrence of psychological aggression (see Table 1). The difference between these observed and the expected counts was statistically significant, $X^2(2, n=533) = 56.04, p < 0.05$.

Hypothesis 2

When comparing prevalence rates of physical assault perpetration by male college student against intimate partners to female college student physical assault perpetration, out of a sample of men ($n=138$) and women ($n=392$): 113 (81.9%) men reported never perpetrating physical assault against their intimate partners and the remaining 25 (18.1%) men reported perpetrating physical assault at least once; whereas 305 (77.8%) of women reported never perpetrating physical assault against their intimate partners and the remaining 87 (22.2%) women reported perpetrating physical assault at least once (see Table 2). The observed and expected counts were not statistically different, $X^2(2, n=530) = 1.02, p > 0.05$.

Hypothesis 3

When computing the frequency of reported physical assaults with a weapon against intimate partner among the college students ($n=532$), 528 (99.2%) reported never using a knife or gun to assault their partner and the remaining four (0.8%) reported using a knife or gun to assault their partner at least once.

Discussion

IPV can take on various forms, including psychological aggression, injury, physical assault and sexual coercion. Studies of IPV focus on both psychological aggression and physical assault, thus the Revised Conflict Tactic Scale incorporated these scales into the survey. From analysis of the responses of the students, we can see that students more commonly engaged in psychological aggression than physical assault. The second highest majority refrains from engaging in both forms of IPV and a relatively small number (but still more than 20%) engage in physical assault alone or physical assault combined with psychological assault. We can conclude that within this sample, psychological aggression is more prevalent than physical assault against intimate partners. This

conclusion is not surprising as previous research studies claim that perpetration of psychological aggression in a marriage serves as a strong predictor of future perpetration of physical assault (Murphy & O'Leary, 1989). This assertion holds true for the college students within this study, revealing a similarity in relationship behaviors between both samples. However, it is important to note that this study found no evidence that men are more likely to report engaging in physical assault than women. Men are often assumed to be more physically aggressive than women but at least according to self-reports, this was not found within the sample. This is not to say that this hypothesis is not true but we cannot reject nor accept the hypothesis based on these data. Lastly, only a small percentage of the college students physically assaulted their intimate partners with a weapon. This is not surprising, as there are few reported incidents of homicidal and non-homicidal IPV with the use of a weapon.

The study methods used to investigate the research questions had limitations that need to be considered when interpreting these data. First, the data used were from a self-reported survey and there is a likelihood of underreporting of IPV. This underreporting can be attributed to the fact that IPV is a sensitive subject and, while participants were given a letter that explained confidentiality, they may have been fearful to honestly report more violent and criminal behavior (i.e., questions on the physical assault scale). Additionally, there could have been unintentional underreporting and/or over reporting because accurately reporting an exact number of occurrences in the past six months may be difficult. This is especially true for the psychological aggression scale because it is difficult to remember every conversation with a partner over a six month period. Another limitation is related to the demographics of the participants. The findings may not be generalizable to the general public, as the population sample was college students in select psychology classes at one university. The sample is not reflective of the overall population in the world, as it does not take into account personal values, cultural background, and other important identifiers that may shape a person's behavior in interpersonal relationships.

The study does tell us about the prevalence of IPV perpetration by a sample of Portland State University students in 2006. Psychological aggression and physical assault against intimate partners was occurring within the student population at a troubling rate. Additionally, while IPV rarely involves weapons, the incidents that do are likely very impactful for not only the victim and their families, but the surrounding community as well. The impact is likely even greater when the weapon usage leads to a fatality and the act is considered an intimate partner homicide. Therefore, it is important to decrease the perpetration of non-homicidal and homicidal acts of IPV. One strategy for preventing IPV is the implementation and enforcement of policies that remove weapons from those who are identified through their prior actions as being at high risk for future perpetration of IPV. A second study was conducted to specifically evaluate the effectiveness of such policies.

Study 2

Introduction

In the United States, 33% of female homicides and 4% of male homicides are committed by intimate partners (Zeoli & Webster, 2010). Additionally, 60% of intimate partner homicides are committed with firearms (Vigdor & Mercy, 2006). In response to these alarming statistics, states have taken legislative action. For example, Oregon recently enacted a new senate bill which gives state officers the ability to seize guns from perpetrators of intimate partner violence. Specifically, police officers are now able to confiscate guns of both convicted domestic violence offenders, as well as people with active restraining orders (Templeton, 2015). Some legislators have pushed to make it easier for victims of IPV to obtain weapons. Despite all these efforts, the majority of homicides involving intimate partners are a result of gun violence (Vigdor & Mercy, 2006). Researchers use these data to advocate for limitations on gun accessibility for domestic violence

perpetrators, but often do not address whether current gun confiscation laws have caused a substantial decrease in homicidal and non-homicidal IPV rates. Therefore, I conducted a review to determine whether and to what extent current gun seizure laws have achieved the goal of alleviating homicidal and non-homicidal IPV. The review also addressed whether there is a relationship between weapon possession and reported occurrences of homicidal and/or non-homicidal IPV.

Before beginning, however, it is important to review the history of gun laws in response to domestic violence and intimate partner violence homicides. In 1968, Congress passed the Gun Control Act, which was the first step towards imposing firearm regulations in the United States. The law included several restrictions, such as outlawing interstate firearm transfers among private parties. However, domestic and intimate partner violence was not a pressing issue during the enactment period so it had gaps in its efficiency towards alleviating gun violence within domestic and intimate partner relationships. To include domestic violence language into the law, the 1996 Lautenberg Amendment was passed, which was a revision of the 1968 Gun Control Act. Most importantly, the amendment "makes it unlawful for an individual convicted of a misdemeanor crime of domestic violence to ship, transport, possess, or receive firearms or ammunition in or affecting commerce" (Browning, 2010). The purpose of the amendment was to include convicted misdemeanor domestic violence offenders into the demographic of those who cannot possess firearms because records show that these acts are frequently prosecuted at the misdemeanor level instead of as felonies. Furthermore, the amendment revises the law to include crimes with attempted use of physical force. This revised language used in the law caused extensive ambiguity between jurisdictions and have been problematic to implement, as there is no clear definition of what physical force entails and if threats should be included into the definition. However, it is important to note that, over a 16 year period, the law denied over 109,000 people from purchasing a gun because of previous domestic violence misdemeanor crimes or restraining orders ("Domestic Violence & Firearms Policy Summary," 2014). This statistic suggests that the law has worked to decrease the likelihood of access to firearms for violent offenders, but fails to prove whether the law has specifically caused a decrease in the actual homicidal and non-homicidal IPV crime rates.

Various states have also addressed the issue of gun violence within intimate and domestic partnerships. For example, sixteen states prohibit misdemeanor domestic violence offenders from purchasing or possessing firearms, with five of the states requiring the surrender of all firearms when convicted of domestic violence misdemeanors (See Table 3). An even larger number of states (n= 36) prohibit firearm possession and purchase for people who have active restraining orders against them with 31 of the states requiring the seizure of all firearms by either the court or police officers (See Table 4). Lastly, three states require the reporting of misdemeanor domestic violence offenses to background check databases, to ensure the prohibition of future firearm purchases for these offenders ("Domestic Violence & Firearms Policy Summary," 2014). All of these states passed laws to address the issue of intimate partner and domestic violence, but whether these laws effectively reduce IPV perpetrated with firearms needs to be evaluated.

Past research on the relationship between gun possession and intimate partner and domestic violence takes various psychological approaches, some of which claim that gun confiscation laws should be enacted. For example, some researchers take a behaviorist approach, as displayed by Berkowitz and LePage (1967), and argue that even the presence of a gun in the immediate environment serves as a stimulus cue for violence and/or aggression. They state that simply having a gun or other weapon in visible sight can amplify aggressive behavior. Thus, they take the stance that gun access should be limited, as ownership or possession can increase the probability of perpetrating violent acts.

Gun possession may be a risk factor for lethal IPV. Researchers have developed a tool called the Danger Assessment instrument which "helps to determine the level of danger an abused woman

has of being killed by her intimate partner” (Roehl, O’Sullivan, Webster, & Campbell, 2005). The instrument consists of 20 questions that assess various risk factors related to the level of danger of a victim. One of the most predictive items is whether the perpetrator has access to a gun, but also includes various other items such as employment and past threats. The researchers take a multi-faceted approach and state that simple access to a gun does not mean someone will commit homicidal IPV, but primarily argue that gun possession is the best predictor of fatal IPV occurrences.

Another approach, which takes a feminist/socio-cognitive approach, is the Duluth curriculum of domestic violence intervention. These researchers assert that power imbalances that perpetuate traditional gender roles contribute to the initiation of violence (Pence & Paymar, 1993). Currently, the Duluth curriculum is used in various domestic violence intervention programs as a way to restructure cognitive beliefs, in regards to gender roles in society. By doing so, the model assuages the need to engage in power-triggered violent behavior, which often includes gun threats and/or gun usage.

On the other hand, other researchers argue that gun confiscation laws should not be enacted and gun possession and/or purchasing of firearms should not be deemed unlawful. One major argument is that, by enacting legislation that restricts gun availability within a home, it will violate citizens’ constitutional right to bear arms. They argue that the effectiveness of current laws is inconclusive, thus it cannot be legally justified to impose laws that impede upon our right to possess a gun (Klein, Mitchell & Carbon, 2006). Additionally, some argue that previous victims of IPV need to have access to guns within their own home in order to protect themselves. By giving victims the ability to have a gun to protect themselves, it will create a more equal environment between members in a domestic or intimate partnership, as victims would then be capable of defending themselves in extreme circumstances. Lastly, gun access within a home may be necessary to protect members of a household from an outside intruder. For example, when a household is located in a gang-related or other crime-prone neighborhood, owning a gun may put the family at ease and decrease stress about possible intrusions.

Clearly researchers acknowledge the problem of IPV, but some fail to use primary data to support their hypotheses and current research evaluating effects of legal interventions is often conflicting. However, there are federal reports of IPV rates that can give insight into whether the gun laws have been effective at addressing the issue of homicidal and non-homicidal acts of IPV. Additionally, these data can discern whether a relationship exists between weapon possession and IPV. Because a lack of gun possession and immediate access could be overcome by individuals who are sufficiently motivated to obtain access to a gun, I hypothesize that current gun seizure laws have not achieved the goal of reducing both homicidal and non-homicidal intimate partner violence. Furthermore, because only a small percentage of IPV is committed with a weapon, I hypothesize that there is no relationship between weapon possession and reported occurrences of homicidal and non-homicidal IPV.

Methods

To address my hypotheses, I conducted a scientific literature review. I first searched for literature that discussed current federal and state laws which specifically address domestic and intimate partner violence. Specifically, I focused on literature published within the past ten years. To determine which studies were most relevant, I conducted a literature search in three databases, including Google Scholar, Med Line and Psych Info. The keywords I used in my search of the databases included “domestic violence and gun”, “gun law efficacy”, and “domestic violence and homicide”. From the search, I found seven studies that focus on IPV gun laws, but only included those that examine the rates IPV after the implementation of the IPV laws. Additionally, I looked at studies that included federal data on homicidal and non-homicidal data to explore previous acts of

intimate partner violence and the trend of intimate partner violence rates before and after the implementation of legal remedies. One major database these studies relied on was compiled by the Bureau of Justice Statistics, which just recently released a report about intimate partner homicides in the United States (Catalano, 2013). From this, I compared the reported rates of IPV before and after implementation of gun repossession laws in several states. The goal of doing so was to yield additional findings, in order to help present implications for more effective legislative policies, in regards to effective preventative intervention strategies and programs.

Results

One study I found determined if and how rates of domestic and intimate partner violence change when state laws are passed that prohibit people with active restraining orders or domestic violence misdemeanor convictions from purchasing guns and allow officers to confiscate guns from these individuals (Vigdor & Mercy, 2006). The researchers compared rates of intimate partner homicides, as reported by the Federal Bureau of Investigation Supplementary Homicide Report, in states with and without these laws and examined changes in these 46 states over a 20 year period (1982-2002). The victims were 10 years old or older and labeled as a spouse, ex-spouse, common-law spouse, boyfriend, girlfriend, or partner of the offender, and included both US citizens and non-US citizens. The results indicated that over the 20 year period, gun purchase prohibition for people with restraining orders leads to a 10% decrease in intimate partner homicides and 12% decrease in intimate partner homicides with firearms. When looking at this effect for year state averages, it was found that the passing of the law was concurrent with a decrease of about four intimate partner homicides within a year, with three of those homicides including firearms. Additionally, screening for misdemeanor domestic violence convictions or restraining orders showed a 9-13% decrease in intimate partner homicides. On the other hand, they found no significant decrease in reported incidents for states with misdemeanor domestic violence laws. Furthermore, laws with possession-only restrictions do not show significant impact, nor do gun purchasing laws for misdemeanor domestic violence offenders or gun confiscation laws. Lastly, gun possession restrictions for those with restraining orders led to an 8% decrease in intimate partner homicides and 9% decrease in intimate partner homicides with a firearm.

Another study reported an evaluation of various practices towards alleviating domestic violence (Klein, Mitchell & Carbon, 2006). One of these practices was the TARGET Program in Montgomery, Alabama. The program established a court system which catalyzes the trial process for high risk batterers who use firearms by minimizing the gap between the arrest date and hearing dates. To determine what qualifies as high risk, police officers get extensive training about how to analyze any arrests, protective orders and warrants related to domestic violence incidents. Additionally, various stakeholders, such as domestic violence programs, judges, citizens and probation officers, were educated about the issue and helped develop a community plan to address the various concerns of domestic violence with firearms. This plan consisted of flagging cases, protecting victims, evaluating offender characteristics and removing guns. The program showed success in the fact that the number of domestic violence homicides decreased from 7 in 2000 to 2 in 2001. Additionally, when officers were trained to look for firearms after a domestic violence incident, only 1-2 percent of future reports involve firearms (Klein, Mitchell, & Carbon, 2006).

Another state approach towards IPV that Klein, Mitchell and Carbon reported on was the implementation of various statutes in New Hampshire on January 1, 2001. These statutes included penalizing people subject to protective orders if they apply for firearms after being served a protective order, notifying the victim of their right to request a protective order and the removal of firearms, permitting officers to seize guns and ammunition while arresting and/or arriving at the scene of a suspected domestic violence incident, and a 15-day period for defendants to request the return of their firearms and ammunition after the expiration of the protective order. In a follow-up study of the success of these statutes, they compared rates of intimate partner homicides before

and after the implementation. Results showed a total of 18 intimate partner homicides in the two years prior to the statutes (1998-2000), whereas in the two years following (2001-2003) there were only 8 reported intimate partner homicides.

Another method used to address my research questions in these studies is to survey women who petitioned for restraining orders. In one study (Vittes, Webster, Frattaroli, Claire, & Wintemute, 2013), detectives within Butte and San Mateo counties were assigned to a pilot program where they were given knowledge about appropriate procedures to take, in regards to removing guns from people as they serve them with restraining orders. Afterwards, the women who requested restraining orders were interviewed via telephone about their experience and perceptions of IPV and firearms. The sample of 17 women were at least 17 years old, spoke English or Spanish, requested a restraining order in the county between October 2007 and June 2010, and their partner had at least one gun confiscated as a result of the restraining order. The survey interview consisted of various demographic questions, as well as examined various aspects of the relationship (i.e., whether the victim and restrained person were married or cohabitating). In the six months preceding the restraining order program, ten of the restraining order petitioners reported fear of safety because the restrained individuals had access to a gun, with three of the women reporting being threatened or abused with a gun in that six month period. At the end of the program, the respondents were asked about their feelings towards gun confiscation effectiveness and necessity, as well as if they were victims of abuse or threats in the follow up period. After evaluating the perceptions and experiences of restraining order petitioners, researchers found that none of the victims reported gun-related abuse in the six month follow-up period, but seven women still reported being fearful of being abused or threatened. One factor that may account for the ruminating fear is the gap between how many guns the petitioners reported the restrained individuals possessed and the actual number of guns that were confiscated by law enforcement. Eight of the petitioners reported a higher number of guns than confiscated, three of the petitioners reported a lower number of guns than confiscated, and five reported an equal amount of guns were confiscated.

An important and comprehensive study by McPhedran and Mauser (2013) focused on gun laws in Canada, searching for a change in trend for female intimate partner homicide incidents. Looking at federal data between 1974 and 2009, the researchers used a sample of homicides between legally married, common-law, separated, and divorced couples who were 15 years old or older. The results revealed a lack of significant change in the already downward trend of firearm homicides, thus implying that these laws had no effect on the pre-existing trend. Any minute changes found were not concurrent with the passing of legislative laws regulating gun possession.

Finally, a study conducted by Zeoli and Webster (2013) aimed to find a possible interaction between alcohol, abuse, and intimate partner homicide by analyzing IPV policies, alcohol taxes, and police staffing and their effect on intimate partner homicide. The researchers looked at federal data from the Federal Bureau of Investigation's Supplementary Homicide Reports of 46 of the largest cities in the US between 1979 and 2003, studying trends in intimate partner homicides with and without firearms. The criteria for the data used included homicide victims killed with and without firearms who were at 15 years or older and categorized as either current spouses, former spouses, boyfriends, girlfriends or partners of offenders. Results showed that restricting firearm access for people with domestic violence restraining orders led to a 19% decrease in intimate partner homicide risk and 25% decrease in intimate partner homicide with firearm risk at the city-level. Additionally, to address the hypothesis that increasing police staffing leads to a decrease in intimate partner homicides with and without firearms, they compared the rates of the two variables between 1979 and 2003. They found that in 1979, when there were an estimated record-high number of two intimate partner homicides with firearms per thousand people and three intimate partner homicides without firearms per thousand people; there was only one police officer per thousand people. However, in 2003, when there were an estimated record-low number of 0.75

intimate partner homicides with firearms and 1.25 intimate partner homicides without firearms; there were roughly 1.75 police officers per thousand people. Despite these promising findings, the researchers found no significant correlation between firearm confiscation and misdemeanor domestic violence offenses. Also, they found that raising taxes on alcohol alone will not lead to a decrease in intimate partner homicides by people subject to restraining orders or misdemeanor convicts. Lastly, the combined interaction of domestic violence policies, alcohol taxes and police staffing had no effect on those with misdemeanor convictions.

Discussion

The results did not support the hypothesis that gun confiscation laws are ineffective at preventing people with restraining orders from committing acts of IPV with gun involvement. Rather, after the passing of such laws a substantial decrease occurred in reported rates of IPV perpetration by people subject to restraining orders. However, the results did support the hypothesis that gun confiscation laws are ineffective at preventing people with misdemeanor domestic violence offenses from committing acts of IPV with gun involvement. Reported rates of violence in each study did not decrease concurrently following the passing of the laws. Lastly, it is inconclusive whether there is a relationship between weapon possession and reported occurrences of homicidal and non-homicidal acts of IPV. I am unaware of a well-designed study to address this issue. Current studies include only small samples and rely on qualitative data.

The literature used in my review had various limitations. First, various research studies revealed a discrepancy between the intent of domestic violence gun laws and actual implementation. Victims report a lack of removal of all guns from the home, which can be attributed to lack of disclosure from defendants about the number of guns in their possession (Vittes, Webster, Frattaroli, Claire, & Wintemute, 2013). This discrepancy between intent and implementation may have led to skewed estimates about the successfulness of these laws. Secondly, the Zeoli and Webster study failed to explain how they measured the level of risk, thus the findings may have been the result of confounding variables that were not considered. Similarly, the Klein, Mitchell and Carbon study failed to explain whether there was a baseline to determine whether the decrease of intimate partner homicides was concurrent with the implementation of the TARGET program, thus it is inconclusive whether this change was a result of the program or other factors that also varied with time. Lastly, and most importantly, the data used relies on previously reported acts of homicidal and non-homicidal IPV and do not take into account unreported incidents, misdemeanors that never went to trial, and inconclusive deaths of partners. Consequently, the effects found may only be pertinent to these reports. Typically, the reported acts are more serious and there are an extensive number of unreported acts. Therefore, as with many domestic violence studies, I was not able to research all acts of IPV. It is unclear whether future research will have the ability to do so, as people may believe that disclosing this information could put them in legal trouble.

Conclusion

IPV is an ongoing social problem and public health issue we are facing in the United States. Ranging from psychological consequences to physical consequences, people are being victimized by their intimate partners. This phenomenon affects people across a range of ages, including young adults in college, many who are forming their first committed intimate relationships. One way to alleviate this issue is the implementation of laws restricting gun access and possession. However, there is a widespread debate about what is the best approach towards gun laws that maintain safety and protect second amendment rights. Past research studies addressing the concern report conflicting findings and have not necessarily proven the laws to be effective in all realms. There is a consensus that the passing of these laws are concurrent with a decrease in IPV perpetration by people subject to restraining orders, but past research shows no correlation between the restrictive

laws and misdemeanor IPV perpetration rates. Furthermore, they don't necessarily ensure the target individuals do not have immediate access to guns or are restricted from purchasing guns from private sellers. By actively assessing the implementation of these laws, we can derive effective means of intervening and preventing further engagement in IPV. My research aims to do so, by looking at reported acts of IPV among college students and assessing the effects on IPV of the overall public after the implementation of gun laws.

The findings from the first study I conducted imply that there is a high prevalence of psychological aggression against intimate partners of college students and less prevalence of physical assaults. This is not to say that physical assault among college students in intimate partnerships is not a significant problem because the consequences are still detrimental. However, it does imply that we need to find ways to address psychological aggression among intimate partners just as actively as we are trying to reduce physical assault among intimate partners.

In regard to the effectiveness of current gun laws, I found a consensus that restraining orders protect citizens from being victims of IPV. This consistent finding may be the reason that so many states have passed laws to ban gun possession for people with restraining orders, as research shows the widespread success. Additionally, there seems to be a lack of success for laws that ban gun possession for perpetrators of misdemeanor domestic violence. This implies that there is a difference in the likelihood of perpetrating violent behavior between people that commit misdemeanors acts and people who are served restraining orders. Laws addressing acts of domestic violence misdemeanors need to take a different, possibly stricter, approach because research shows the laws are intended for more violent people.

Some of the studies have attributed the success of gun prohibition and/or confiscation laws to various potentially associated factors, such as education of families, children, judges, mandatory reporting of restraining orders and/or domestic violence misdemeanors, and an increase of police staff who have specific training for confiscating guns. Further research should compare groups with and without these factors to determine if it is best practice to include these supplementary techniques into IPV guns laws. The issue IPV is a very sensitive topic, which could account for the conflicting research that exists. However, researchers should not use that reason to deter themselves from analyzing the impact of various legislative measures. IPV is a social problem and public health issue that needs to be addressed sooner than later, for the sake of future potential victims.

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Tables

Table 1

Number of Students Reporting Psychological Aggression and Physical Assault Perpetration

	Physical Assault		Total
	No	Yes	
No	197 (37.0%)	9 (1.7%)	206 (38.7%)
Psychological Aggression			
Yes	224 (42.0%)	103 (19.3%)	327 (61.3%)

Total	421 (79%)	112 (21.0%)	533 (100%)
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Note. $\chi^2 = 56.04$, $p < .05$.

Table 2

Number of Students Reporting Physical Assault Perpetration by Gender

Physical Assault	Gender	
	Males	Females
Yes	25 (18.1%)	87 (22.2%)
No	113 (81.9%)	305 (77.8%)
Total	138 (100%)	392 (100%)

Note. $\chi^2 = 1.02$, $p > .05$

Table 3

Number of States with Gun Laws for Domestic Violence Misdemeanants

Gun Laws for People With Domestic Violence Misdemeanors	Number of States With This Law
Prohibits misdemeanor domestic violence offenders from purchasing or possessing firearms	16
Requires immediate surrender of firearms when convicted of domestic violence misdemeanors	5
Mandatory reporting of domestic violence misdemeanor convictions to the database used for background checks for the purchase of firearms	3

Note: Table constructed with information from "Domestic Violence & Firearms Policy Summary,"

(2014)

Table 4

Number of States with Gun Laws for People Subject to a Domestic Violence Protective Order

Gun Laws for People With A Domestic Violence Protective Order	Number of States With This Law
Prohibits people who are subject to domestic violence protective orders from purchasing or possessing guns	36
Requires or authorizes law enforcement officials to seize firearms when serving a domestic violence protective order	4
Requires or authorizes the court to seize firearms when granting a domestic violence protective order	27

Note: Table constructed with information from "Domestic Violence & Firearms Policy Summary,"

(2014)

Glial Cell Involvement in Early Alzheimer's Disease

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Abstract

Glial cells, the resident immune cells of the brain, are important for brain health; they perform critical protective functions following brain injury, during nervous system development, and to support general neuronal activity. Following brain injury, glia quickly respond by cleaning up neuronal and synaptic debris. In addition to their role as the cleaning cell of the brain, recent research has shown that during development, glia also shape and fine-tune neural connections by eliminating weak synapses fated for removal. However, whether glial cells also continue to remodel synaptic architecture in the adult brain is unclear. Moreover, synaptic loss is an early hallmark of Alzheimer's disease (AD), but whether glial cells play a role in this pathophysiology remains mysterious. In this study, we investigate the role of glial cells in AD-related synaptic loss using a *Drosophila melanogaster* model of AD. Specifically, we will explore the role of the glial engulfment receptor Draper, which is essential for glial clearance of neuronal debris after injury, and evaluate its effect on synaptic loss in the AD fly model. For these studies, we will use immunohistochemistry and western blotting techniques, as well as the power of *Drosophila* genetics. Through this project, the effects of amyloid beta on synaptic molecule expression are assessed and the contribution of the glial engulfment receptor Draper upon amyloid-beta induced synaptic changes are identified.

Introduction

Alzheimer's disease (AD) is a progressive neurodegenerative disease, which is implicated by hallmark aggregations of extracellular amyloid beta protein. Mutations in the amyloid precursor protein (APP), causing a truncated version of the protein have been identified as a risk factor for Alzheimer's disease (Goate et al. 1991; Citron et al. 1992). However, attention is also shifting to the immune cells of the brain called microglia. As the resident immune cells of the brain, they are actively surveying the brain parenchyma for injury (Nimmerjahn et al. 2005). Upon injury, they quickly respond, by changing their morphology and protein expression to engulf cellular and synaptic debris through active phagocytosis (Ivacko et al. 1996). In addition, microglia are critical for proper brain development as they shape synaptic connections during development. It has been shown that developing mice deficient for one essential microglial engulfment receptor displayed unrefined synaptic connectivity due to deficits in synaptic pruning (Paolicelli et al. 2011; Zhan et al. 2014).

In *Drosophila*, the glial engulfment receptor Draper has been shown to be essential in glial engulfment of neuronal debris following injury (MacDonald et al. 2006). Upon axon injury, glial cells recruit their membranes at the site of injury and upregulate Draper. When Draper is knocked down or glial phagocytic activity is inhibited, axon fragments persist and are not cleared (Doherty et al. 2009). While Draper is specific to *Drosophila*, it is highly conserved and its mammalian homolog MEGF10 shows similar function in glial engulfment in mammals (Chung et al. 2013). This positions Draper as an essential and specific glial receptor for the interaction between glial cells and damaged/dying neurons and allows us to use the powerful *Drosophila* model to investigate conserved pathways.

In improving our understanding of Alzheimer's disease, recent data suggests that amyloid beta aggregation is not the very first or critical molecular symptom of Alzheimer's disease (Scheff and Price 2003). In mice, synaptic loss and dysfunction has been observed before any sign of hallmark aggregation (Yoshiyama et al. 2007), however whether glial cells are involved in this process is not clear. In addition, defects in glial cells have been shown to accumulate in the aging brain potentially leading to disease (Hanisch and Kettenmann 2007; 2010). We aim to validate a *Drosophila* model of Alzheimer's Disease and create a timeline of when synaptic loss occurs in relation to neurodegeneration. Using this timeline, we will then be able to examine the role of glia in this process by investigating whether synaptic loss still occurs in the AD fly model when Draper is knocked out. By investigating the very initial pathophysiology observed in Alzheimer's Disease and its associated signals, we hope to shed light on a potentially powerful mechanism to halt Alzheimer's Disease before it leads to progressive neurodegeneration and cognitive decline.

Methods

Fly Lines

w+/-; elav-Gal4/ UAS-A β arc; +

w+/-; elav-Gal4/ w118; +

w+/-; elav-Gal4/BRP-SNAP; UAS-A β arc

w+/-; elav-Gal4/ BRP-SNAP; +

w+/-; elav-Gal4/ BRP-SNAP; Drpr Δ 5 rec 9/UAS-A β arc Drpr Δ 5 rec 9

Crosses were set up and maintained at 25° C. Flies were collected every 2 days (M, W, F) and incubated at 30° C.

Adult Fly Brain Fixation

Fix Solution 1- 1x PBS, 0.01% Triton-X, 4% Paraformaldehyde

Wash Solution 1- 1x PBS, 0.01% Triton X

Fix Solution 2- 1x PBS, 0.1% Triton-X, 4% Paraformaldehyde

Wash Solution 2- 1x PBS, 0.1% Triton X

Adult flies from chosen groups were anesthetized and heads removed. Heads were fixed in Fix Solution 1 for 20 minutes with rocking. Heads were washed in wash solution 1 3 x 2 minutes. Brains were dissected in wash solution 1 in a standard dissection plate. Newly dissected brains were transferred to new tubes with wash solution 1. Wash solution 1 was pipetted out and replaced with Fix Solution 2. Brains were fixed for 20 minutes at room temperature with rocking. Brains were washed 3 x 2 minutes in wash solution 2.

Antibody Staining

Primary antibody master mixes were prepared at the following concentrations, diluting the antibody in wash solution 2:

Mouse Anti-Draper 1:400; Guinea Pig Anti- Draper 1:400; Mouse Anti-A β 1:2000; Mouse Anti-Bruchpilot 1:50.

Secondary antibody master mixes were prepared at the following concentration, diluting the antibody in wash solution 2:

Mouse 488 1:400; Guinea Pig 546 1:400 (Jackson Immuno).

Brains were incubated in primary antibody with shaking at 4°C overnight. Brains were washed 4 x 30 minutes in wash solution 2. Brains were then incubated in secondary antibody for 2 hours at room temperature with shaking and then washed 4 x 30 minutes in wash solution 2.

BRP-SNAP Staining

SNAP Tag mix was prepared at a concentration of 1 μ M in 1x PBS with 0.3% Triton X. Brains were permeabilized for 1 x 10 min in 1x PBS with 0.3% Triton X for 10 min prior to staining. Brains were stained for 15 minutes at room temperature in a glass dissection dish with rocking. Brains were washed 1 x 5 min in 1x PBS & 0.3% Triton X and 1 x 5 min in 1x PBS.

Mounting

Brains were transferred to the glass well of a dissection dish and the wash solution was carefully removed with a pipette. A drop of Vectashield (Vector Labs) was then immediately dispensed onto the brains. Brains were incubated for 30 minutes at 4°C or overnight if desired. Slide preparation required placing a strip of clear tape onto a clean microscope slide. A template was used to trace and cut 4 wells into the tape. Brains were carefully transferred from the dissection dish to their appropriate well on the microscope slide. Excess Vectashield was carefully removed and brains were aligned and oriented with antennal lobes facing up. Small drops of Vectashield were added once all brains were oriented and a coverslip was gently dropped onto the wells. The coverslip was sealed around the border with a layer of CoverGrip (Biotium).

Confocal Microscopy and Quantification

Images were taken on a Zeiss LSM 700 confocal microscope using a 40X oil immersion lens. For Draper staining, 11 slices through the Z plane were taken per brain at an interval of 1 μm . For Bruchpilot staining, 35 slices were taken through the Z plane at an interval of 0.5 μm .

Quantification was completed using the Volocity software (Perkin & Elmer). For Draper staining, the 5 slices, which depicted the same anatomical region in each sample, were quantified. Two standard circles were used to measure regions within the cortex above the antennal lobes. A threshold for background fluorescence was set in addition to a restriction of voxels 0.2 μm in size or greater. For Bruchpilot staining, the 20 slices, which depicted the same anatomical region, were quantified. The antennal lobes were traced out, cropped and quantified. A threshold for background fluorescence was set in addition to a restriction of voxels 0.2 μm in size or greater. Data was analyzed and graphed in GraphPad Prism 6.

Western Blot Protocol

Whole heads were pulled and collected in 1X loading buffer (10 heads per 30 μL of 1x loading buffer). Samples were homogenized using a pestle and centrifuged for 10 minutes at 4°C. Supernatant was collected and boiled for 10 minutes at 95°C and frozen at -80°C.

10x running buffer was diluted to 1x and chilled at 4°C prior to use. 12 μL of sample was loaded into each well of a 10% Tris-HCl gel. 1.5 μL of protein ladder was loaded into edge lanes. Gel was run at a constant 125V for 2 hours.

The wet transfer sandwich was prepared after the fiber pads, filter paper, and nitrocellulose membrane were soaked in transfer buffer. Gel sandwich was placed back in gel and ran at 100V for 90 minutes.

Membrane was soaked in methanol and then blocked with SEA Block (Calbiochem) for 30 min. Membrane was incubated overnight at 4°C with primary antibodies of the following concentrations: Rabbit Anti-Draper 1:2000 and Sheep Anti-Tubulin 1:4000. Membrane was washed 3 x 10 min in 1xPBS-Tween. Secondary antibodies (Rabbit 790 1:2000 & Sheep 680 1:2000) were prepared in 1X PBS and applied to membrane for 2 hours at room temperature. Membrane was washed 2x5 minutes in 1xPBS-Tween and 2x 5 minutes in 1xPBS. Membrane was visualized on Li-Cor Odyssey Imager.

Results

Note:

Control: w+/-; elav-Gal4/ w118;

Experimental: w+/-; elav-Gal4/ UAS-A β arc; +

Flies show progressive A β accumulation in cortex

In verification of our Drosophila model, brains were stained for Amyloid Beta which can be seen in cyan within the cortex (Figure 1). Control (w +/-; elav-Gal4/w118) flies showed no Amyloid Beta plaques. In addition, Amyloid Beta displays an increase in aggregation from the 1-3 D time point to the the later time point of 12-14 Days. Amyloid Beta was not quantified.

Taken together, these initial results allow for a confirmation that our model system displays characteristic Alzheimer's disease pathology.

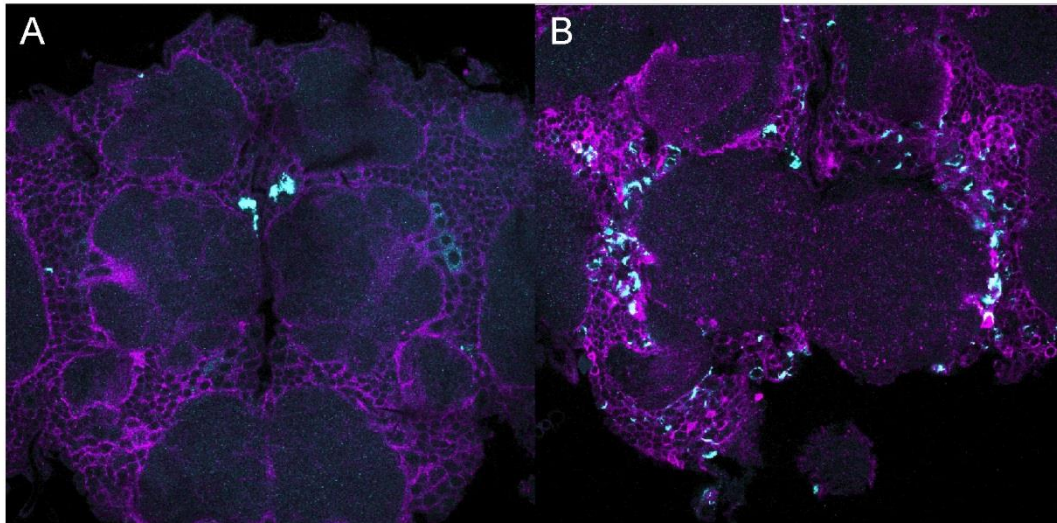
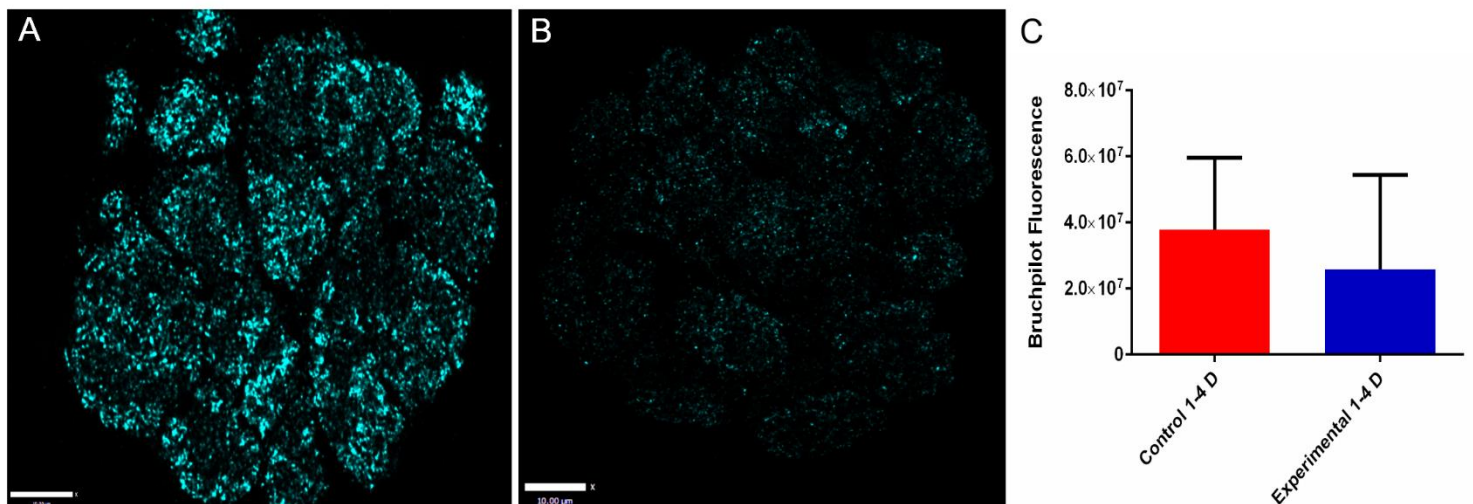


Figure 1: Flies show progressive A β aggregation in cortex. A) Elav-Gal4 UAS-A β arc 1-3 Days immunostained for Draper (magenta) and Amyloid Beta (cyan). B) Elav-Gal4 UAS-A β arc 12-14 Days immunostained for Draper (magenta) and Amyloid Beta (cyan).

Draper fluorescence is increased in young AB flies

Whole brains were stained for Draper (Figure 2) and the Draper fluorescence within the cortex was quantified (Figure 3). The Draper fluorescence was elevated, although not significantly, in flies expressing the A β -arc mutation. This data suggests that Draper's engulfment activity within glial cells is possibly elevated as well.

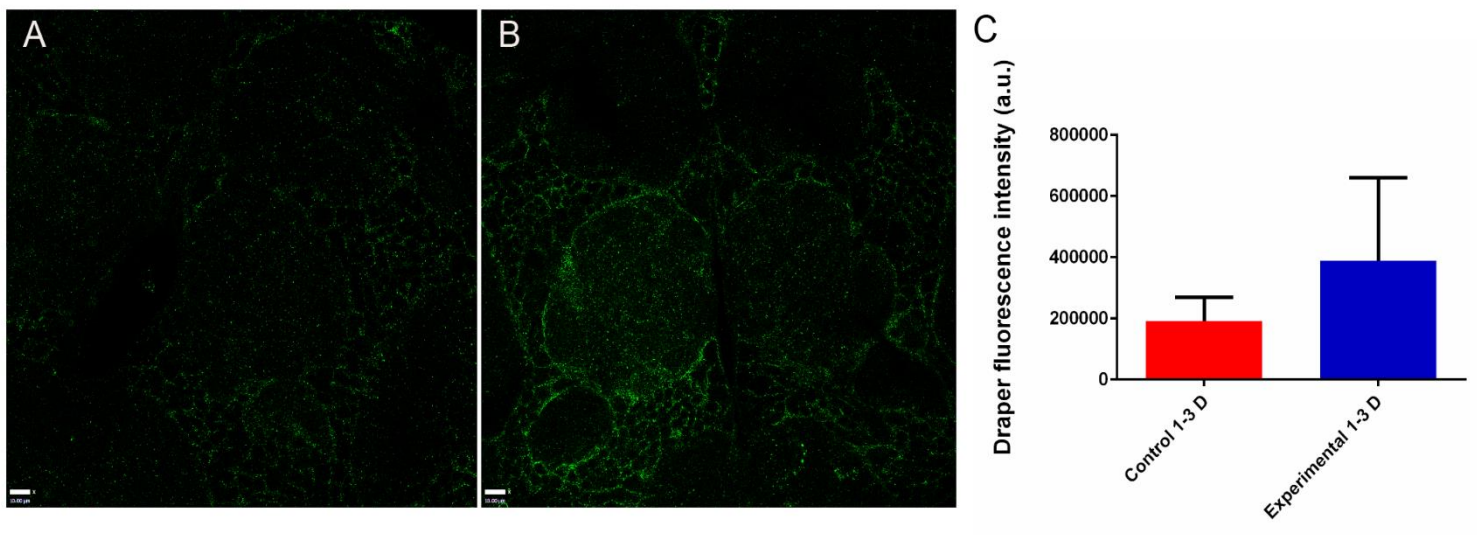
Figure 2: Draper fluorescence is increased in young A β flies. A) Elav-Gal4 x Wt 1-3 Days after eclosion immunostained for Draper (green). B) Elav-Gal4 UAS-A β arc 1-3 Day flies immunostained for Draper. n= 6-15. C) Fluorescence within two standard circle regions within the cortex was quantified using Volocity software. n= 6-15.



Synaptic fluorescence and density is decreased in young A β flies

To further delineate glial activity, synaptic levels were assessed via immunofluorescent staining targeting the synaptic protein Bruchpilot. Control flies displayed elevated fluorescence, although not statistically significant, suggesting that A β -arc expressing flies have a deficit in synaptic density.

Figure 3: Synaptic density is decreased in young A β flies. A) Elav-Gal4 x Wt antennal



lobe aged 1-4 days stained for Bruchpilot synaptic protein. B) Elav-Gal4 UAS-A β arc aged 1-4 Days stained for Bruchpilot synaptic protein. n= 8-13. C) Fluorescence within antennal lobes was quantified using Volocity software. n= 8-13.

Draper protein is similarly expressed in whole brains of WT and AD flies

In order to more quantitatively assess Draper levels within the control and experimental groups, a Western Blot was performed to directly analyze protein levels. When quantified and normalized against the corresponding total protein gel, Draper protein levels were similar amongst both control and experimental groups. This suggests that minimal differences exist in Draper protein expression between groups in whole brain lysates.

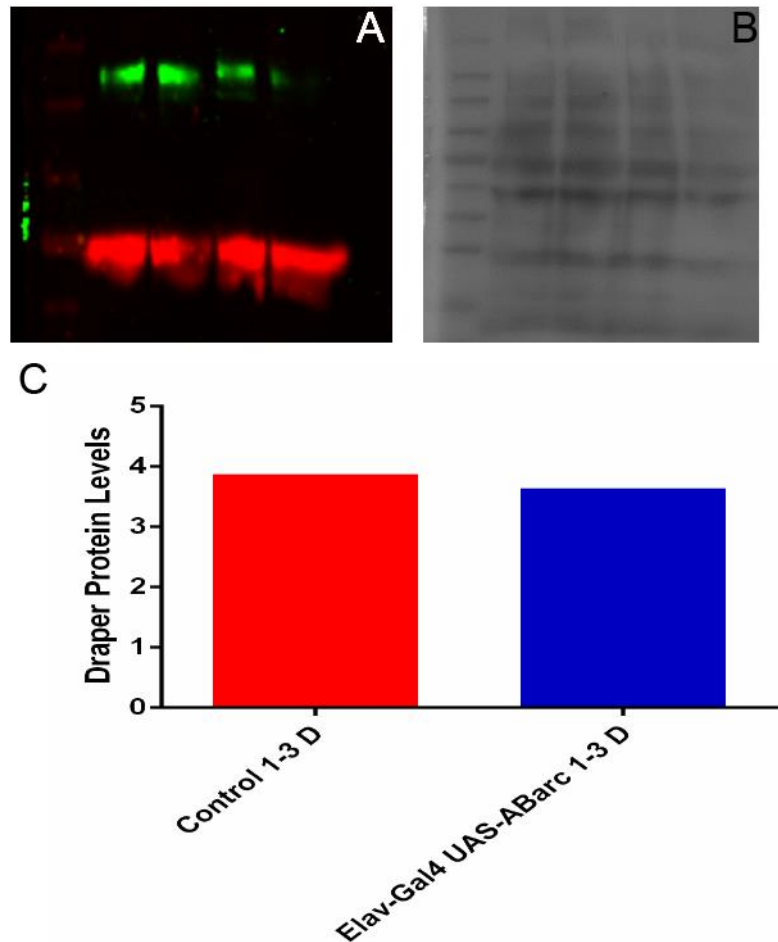


Figure of

left:
2:

Days, Lanes 3 & 4: Control 1-3 Days. Green band refers to Draper. Red band refers to Tubulin. B) Total protein gel served as loading/normalization control. C) Draper bands were quantified and normalized against corresponding lanes in total protein gel.

4: Western Blot Draper and Tubulin. A) From Ladder, Lanes 1 & Experimental 1-3

Draper deficiency does not rescue synapses

To ultimately evaluate whether Draper exerts some role on synaptic loss in the earliest stages of Alzheimer's Disease, Draper null Aβarc flies were examined for Bruchpilot fluorescence. Draper null flies in an Aβarc background showed no rescue or increase in synapses in comparison to Aβarc flies.

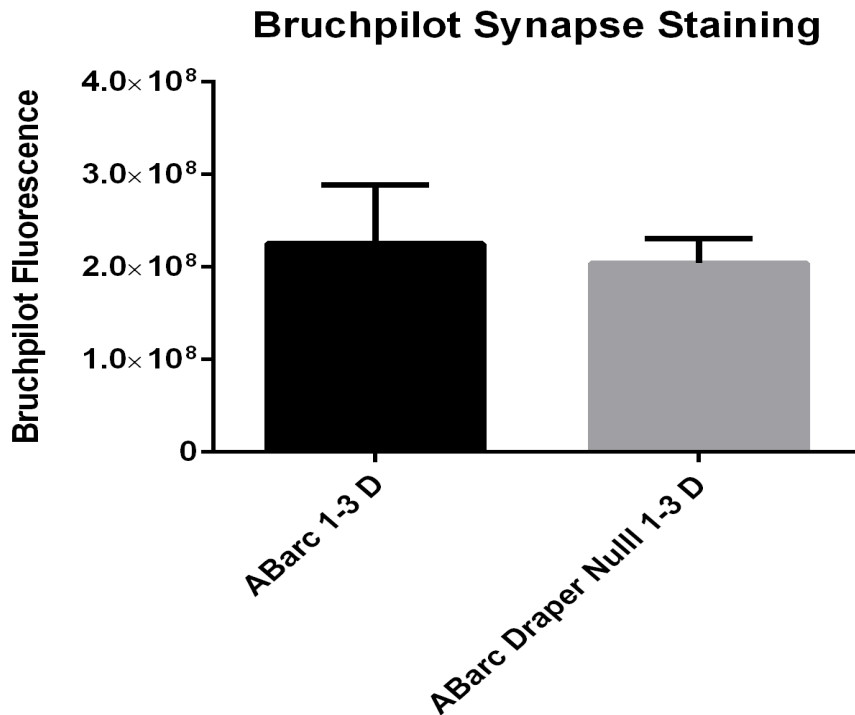


Figure 5: Draper is not essential for AD synaptic loss. w +/-; elav-Gal4/BRP-SNAP; UAS-Aβarc in left column; w +/-; elav-Gal4/ BRP-SNAP; Draper null/UAS-Aβarc Draper null in right column. Synapses were stained using a molecular probe against an endogenous SNAP-Tag attached to Bruchpilot. n= 11-16.

Discussion

Glial cells are a multi-faceted cell type playing essential roles in development, injury, and maintenance. Their significant contribution to the brain microenvironment makes them a prime candidate to investigate what effect they may have on early Alzheimer's disease (AD), which is best characterized by synaptic loss that occurs before the onset of symptoms like memory loss. As glial cells are capable of pruning and engulfing synapses during development, this study aimed to investigate how glial cells may be involved in synaptic loss in the context of Alzheimer's disease. More specifically, the highly conserved glial engulfment receptor Draper has previously been shown to be crucial for glial engulfment activity following neuronal injury (MacDonald et al. 2006; Doherty et al. 2009). Therefore, we hypothesized that Draper may also be upregulated and involved in AD related synaptic loss.

For this study, we used a *Drosophila* model of Alzheimer's disease, in which human Aβ is expressed pan-neuronally in the fly brain. In humans and mouse models of Alzheimer's disease, this protein forms aggregates and leads to destruction of neurons. More specifically, the expressed Aβ protein in our fly model contained the arctic mutation, which is known to cause severe protein aggregation in human disease (Nilsberth et al. 2001). In our model, we observed the formation of Aβ-aggregates in the fly brain shortly after eclosion, and they increased in size and number with age. In addition, we observed motor deficits in the Aβ-expressing flies and a reduced lifespan compared to age-matched controls. The advantages of this model system in *Drosophila* are the ability to selectively express human Amyloid Beta in all neurons by utilizing the Elav-Gal4 UAS system. The limitations are that the current model does not allow for adult specific Aβ expression. Instead, Aβ is expressed throughout

development thereby quickly forming plaques after eclosion. This is in stark contrast to human Alzheimer's Disease pathology which requires decades for A β plaques to form.

By utilizing immunohistochemistry techniques, Draper and the presynaptic protein Bruchpilot were visualized and quantified in both experimental A β -expressing and age matched non-A β expressing control groups. Bruchpilot staining revealed that synapses were decreased in young (1-4 Days) A β flies (Figure 3), while Draper staining in young (1-3 day old) A β flies showed an upregulation of Draper in the olfactory antennal lobe region of the adult fly brain (Figure 2). These studies suggested that Draper may play a role in glial cell mediated synaptic loss in AD.

To further investigate whether Draper is involved in early synapse loss in AD, an A β -expressing fly line in a Draper null mutation background was created. This allowed us to explore whether the removal of Draper would result in an increase or rescue of synapses. Staining with a fluorescent molecular probe against an endogenous SNAP-Tag attached to Bruchpilot allowed for more specific and thorough staining in a control group (w+/-; elav-Gal4/BRP-SNAP; UAS-A β arc) and experimental Draper null group (w+/-; elav-Gal4/ BRP-SNAP; Draper null/UAS-A β arc Draper null). This study revealed that Draper removal conferred no increase or rescue of synapses (Figure 5). This preliminary data suggests that Draper is not essential in inducing synaptic loss in AD. However, this does not eliminate the possibility that glial cells contribute to synaptic loss. Alternative glial engulfment pathways such as the Crk/Mbc/dCed-12 may be implicated in synaptic loss. The Crk/Mbc/dCed-12 pathway acts in a semi non-redundant fashion downstream of Draper to actively phagocytose and uptake cellular debris (Ziegenfuss et al. 2012). While Draper is required for initial glial activation in response to injury, this study suggests that it is not the key player for AD-related synaptic loss. Other mediators in the glial engulfment pathway downstream of Draper, such as the Crk/Mbc/dCed-12 pathway, should be investigated in future research.

Although Draper was seen to be upregulated in young A β flies but does not rescue synaptic loss when knocked down, it may be upregulated for a myriad of other biological reasons. Glial cells are known to engulf A β plaques and prune synapses during development (Bolmont et al. 2008; Paolicelli et al. 2011; Chung et al. 2013) and this could be the reasons Draper upregulation was observed in our *Drosophila* AD model. Future work should include refining the AD model in *Drosophila* in order to better mimic the pathophysiology of AD. For example, in our experimental group, A β was expressed throughout development and plaques form a few days after eclosion. In order to create a more realistic AD model, A β could be expressed strictly in adult flies without perturbing development. This may model the human age-related disease more closely. This may be accomplished through the use of a weaker neuronal driver than Elav-Gal4, or through genetically inhibiting A β expression during the fly's development.

In conclusion, this study provides a preliminary depiction of the role of Draper in glial mediated synaptic loss in the context of AD. Further research would include repeating these experiments and investigating other engulfment pathways which may be implicated in the earliest symptoms of AD.

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Trajectory Analysis of Black Carbon in the Arctic Region

By

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Abstract

Black carbon (BC) is a troubling particulate. Commonly known as soot, BC forms through the incomplete combustion of fossil fuels, biofuels, and biomass. It has a very low albedo compared to natural particulates making it a very efficient absorber of solar radiation. As BC is deposited on snow and ice, albedo is decreased - enhancing solar heating and increasing meltwater production. With rising air temperatures, melting rates of polar ice are increasing and are being enhanced by BC, leading to accelerated global sea level rise.

This study aimed to document sources and deposition areas of BC in the Arctic. Utilizing HySplit, an air trajectory model, patterns of BC trajectories are assessed. Spatial patterns of deposition are estimated from known sources and source regions predicted from known deposition locations through the use of backward trajectory. Atmospheric circulation transports BC from temperate regions into the Arctic. The strength and location of the polar front in relation to the North Atlantic Oscillation is a dominant controlling factor.

Preliminary results show reoccurring potential sources located in the Northeastern United States, Nova Scotia, Northern United Kingdom, and the Scandinavian Peninsula with large deposition events occurring within the first six months of the year.

Keywords: Arctic, Greenland, Black Carbon, BC, Albedo, Ice, Snow, Climate Change, Global Warming

Introduction

Global ice coverage has been steadily decreasing over the past 40 years (Vinnikov et al. 1999). Many observational and climate modeling studies have shown a trend towards decreasing ice in the Arctic due to warmer conditions. Rothrock et al. (1999) demonstrated that the perennial sea ice in the Arctic Ocean was 1 m thinner in the 1990's than it had been in two to four decades. Volume was calculated to be down by $\sim 40\%$ when compared to previous years. In his words, "The thinning is remarkable in that it has occurred in a major portion of the perennially ice-covered Arctic Ocean" (Rothrock et al. 1999).

While atmospheric CO_2 concentration is named the largest factor in global climate warming, black carbon (BC) also plays an important role in regions predominantly covered by snow and ice. BC is a particulate created by incomplete combustion of fossil fuels, biofuels and biomass (Jiao et al., 2014). Particle size can range from ~ 0.1 to 1 micron. Dependent on the size, the particulate can be transported long distance (~ 1000 km) and be deposited on snow and ice. Residence time of BC particles (< 1 μm) in the atmosphere is up to two weeks while larger particles are deposited within a matter of days or until they encounter precipitation (Mahowald et al. 2011).

BC can create regional issues, such as localized warming of regional glaciers, when the particles are large, or global issues, such as polar warming, when the particle released is small enough to be transported long-range. BC transport into the Arctic is affected by the strength and location of the polar front in relation to the North Atlantic Oscillation (Wallace & Thompson, 2002; Koch & Hansen 2005). Aerosol transport into the Arctic is greatest during late winter and early spring. These large transport events are collectively known as Arctic haze (Barrie et al. 1986).

Once deposited on snow and ice, BC is very effective at increasing the absorption of solar radiation of the surrounding ice and snow particles. According to Hadley and Kirchstetter (2012), radiation transfer calculations for 10-100 ppb of BC in the cryosphere decreased albedo by 1-5%. Globally BC reduces albedo and creates a positive radiative climate forcing (Hadley & Kirchstetter 2012). Positive radiative climate forcing occurs when more solar radiation is incoming to a climate system, warming the system overall. Smaller particles are more effective at absorbing solar radiation. Radiation transfer calculations indicated that minute amounts of BC from 10–100 ppb decrease snow albedo by 1–5% (Hadley and Kirchsetter 2012). Natural sediment, dust, and other particulates are also present in snow

and ice. However, these other particulates are less effective in decreasing albedo than BC. BC is effective in absorbing solar energy across the entire light spectrum, whereas other particulates are only effective at absorbing specific ranges within the solar radiation spectrum (Yang et al. 2009). BC's effectiveness in decreasing albedo makes it a larger concern to Arctic ice and snow.

Snow grain size is an important factor when calculating radiation transfer from BC to snow. As snow becomes older and begins to melt, the decrease in albedo caused by BC is amplified (Wiscombe and Warren, 1980). Snow grains characterized by effective optical radii, a simplified sphere used to calculate the optical properties of snow grains by radius size, (R_{eff}) of 55, 65 and 110 μm were tested and demonstrated an increase in affinity for solar radiation by BC, lowering the albedo of the snow particles the BC was deposited on, as the grains increased in size (Figure 1). In Figure 1, snow grain radii increases from 1A to 1C. As the snow grain radii increases, the ability of BC to significantly lower the albedo of the snow particles also increases (Figure 1C). This means, as snow melts and begins to aggregate, or clump together, the ability of BC to lower the albedo of the snow increases, causing further and faster melting rates (Hadley and Kirchseter 2012).

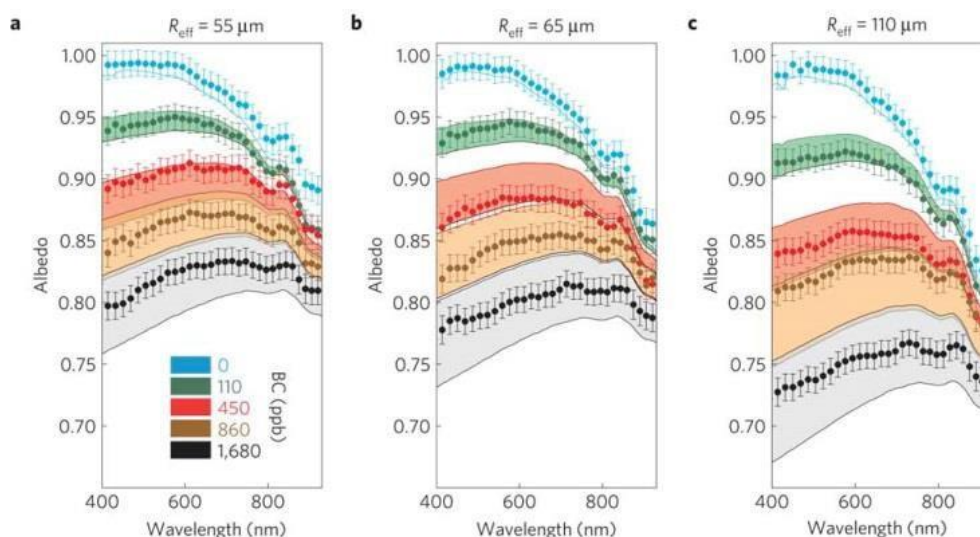


Figure 1 Effect of black carbon on different sizes of snow grains characterized by optical effective radii (R_{eff}) of 55, 65 and 110. Hadley, Odelle and Kirchstetter, Thomas (2012)

The Russian Arctic has the highest levels of BC, largely due to biomass burning. Industrial sources play a role, but the Arctic as a whole has become cleaner since 1999 (Hegg et al. 2010). While there has been a reduction in emissions related to air pollution policies in

many nations worldwide (Novakov et al. 2003), the effect of emissions on snow and ice is being compounded by the rising temperatures due to other climate warming. Although industrial emissions from China have grown within the past 20 years, they have been shown to have a stronger local effect on snow and ice rather than long distance effects in the Arctic (Koch and Hansen 2005). Greenland has the lowest amount of BC in the Arctic with an average of 2 ppb on the ice sheet. However, during the summer season, BC levels increase to 20 to 30 ppb as the snow and ice begin to melt (Hadley and Kirchsetter 2012). These higher levels of BC enhance melt rates and lead to a larger reduction in snow and ice. Even though snow and ice can still appear to be clean to the human eye at 100 ppb, the increase in absorption of solar radiation is significant.

Previous studies using a variety of modeling systems have been performed to attempt to identify source areas of BC in the Arctic cryosphere. The 2014 AeroCom assessment of black carbon in the Arctic cryosphere was performed using the Community Earth System Model. A 2005 study by Koch and Hansen used the Goddard Institute for Space Studies ModelE to determine the distant origins of BC in the Arctic snow, sea ice and glacial coverage (Figure 2). Industrial BC emissions were centered in the temperate regions in the heavily populated post- and current-industrial regions (Figure 2). Biomass BC emissions were focused in the Southern hemisphere in developing regions of South America and the African continent (Figure 2).

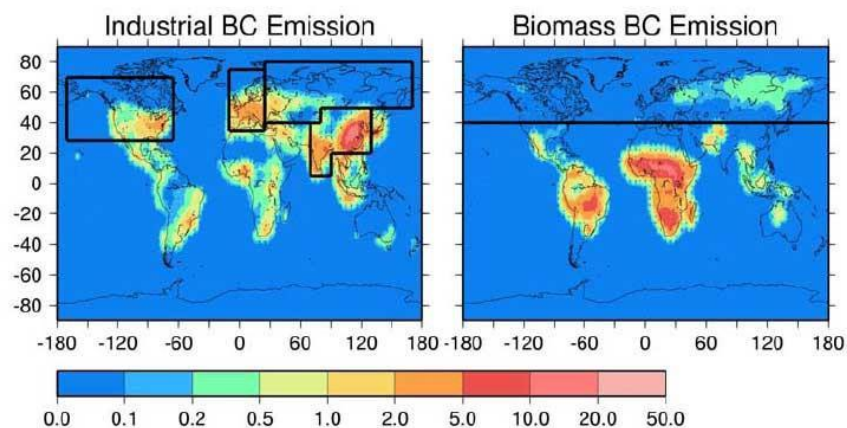


Figure 2 Black Carbon Emissions: Industrial and biomass black carbon emissions with boxed areas showing regions assumed in the model experiments. Credit: NASA/GISS

My work utilized the Hybrid Single Particle Lagrangian Integrated Trajectory Model (HySplit), a computer model created by the National Oceanic and Atmospheric

Administration's (NOAA) Air Resources Lab (ARL) (Draxler & Rolph). HySplit calculates air parcel trajectories, dispersion, and deposition of atmospheric pollutants. In this study, I have utilized only the trajectory function of the HySplit model. The model was used to perform a backward trajectory of black carbon from one set location within the Arctic that has measurements of BC. By performing a backward trajectory from this point, one can identify areas of possible sources of BC. Meteorological data from the Global Data Assimilation System (GDAS) includes historical precipitation and wind data from which past trajectories can be calculated.

The location of BC measurements was 72.58 N, 38.48 W on the Greenland Ice Sheet. Greenland Summit Station was established by the National Science Foundation and the Danish Commission for Scientific Research. This station is part of the Earth System Laboratory (ESRL) Global Monitoring Division of NOAA which provides meteorological and observational data from the Summit Station online for use by the scientific community. This location was chosen for the amount of corresponding in situ data available for these areas.

Methodology

Datasets collected by previous studies were utilized for the meta-analysis. In situ measurements collected by Warren and Doherty (2008) were used to identify times of large deposition events on the Greenland Ice Sheet. Data collected centered around the Greenland Summit Station and nearby areas. Meteorological data from Greenland Summit Station was used to back-calculate the snowfall that occurred in the years 2006, 2007 and 2008. Snowfall records were matched with sampling from the vertical pit collection done by Warren and Doherty (2008). Their team collected 300 samples at 24 sites at different depths and in different seasons to look at seasonal variation and obtain a detailed vertical profile. Data collected from near the Greenland Summit Station site during the summer of 2008 was used. Data was collected from 12-800 m away from a road to make sure that background levels were not influenced. Sampling at 100 m can be well representative of the frequency of source distribution (Warren et al. 2008).

Utilizing the HySplit aerosol ready trajectory model, backward trajectories were run for a location in central Greenland. PC and web-based platforms were used with mapping images enabled. Location coordinates were set for 168-hour runs at 6-hour intervals. To match trajectories within field data gathered from previous studies, GDAS archived meteorological data from 2006, 2007 and 2008 was used. Within the HySplit settings, precipitation was enabled. Trajectories were run with a single trajectory protocol over a 12-month period for

2006, 2007 and 2008 to identify if trajectory patterns followed a seasonality or had a random variability of dispersion. Trajectories were saved as .PDF file format with end point plot with precipitation detail and coordinates enabled. Endpoint plot files were then used to overlay the four trajectories per month on one coordinate plot. This allowed for patterns to be more easily recognized within the trajectories. Trajectories were compared on a year and month basis to identify patterns of seasonality.

Results from the air trajectories provided latitude and longitude coordinates for the location of the trajectory at 6-hour intervals over the 168 hour period. Once the backward trajectories were collected, they were classified into three groups: 1. Trajectory originated over Greenland; 2. Trajectory originated over the ocean; and 3. Trajectory originated over a land mass. Trajectories that fell into category (1) were dismissed as potential sources of BC because of the lack of large industrial or biomass sources located within Greenland. While category (2) may have had emissions from marine shipping, it was dismissed due to the lack of major source possibilities. Category (3) was further divided into two subcategories: (a) The point of origin in populated area (b) The point of origin in the unpopulated region. Out of the two subcategories, category (b) was dismissed while subcategory (a) was further analyzed to determine if the altitude of the air mass at the origin was low (below 1000 m) or high (higher than 1000 m). Air trajectories that originated over a populated area on a land mass with wind currents originating close to the ground (1000 m or less) were determined to be likely areas of the BC source. With these trajectories identified, in situ data was analyzed to estimate when mass deposition events, events resulting in >10 ng of BC within the snow pack, occurred. The dates of mass deposition from in situ data was then compared to the dates of target trajectories to determine if the trajectories coincided with the deposition events. Trajectories that did coincide with deposition events were gathered and analyzed further for possible source attribution. Coordinates of the Air masses that originated with low altitude over populated land masses were mapped, and a search was done of nearby industrial processes using Google Earth. If industrial processes were readily found within a 50 km area, the source type and location was noted. Searches were also done knowing the time and date of the air mass origination to determine if large biomass sources (i.e. wildfires) may have been present in the area.

Annual wind roses were collected from the ESRL Global Monitoring Division of NOAA Greenland Summit Station data files for 2008. Meteorological data from Greenland Summit Station was used to generate annual wind roses for 2006 and 2007 in EXCEL. Wind roses were analyzed to determine mean annual wind direction and speed to provide a climatology of wind flow over the area.

Results

Over the course of the study, 177 backwards trajectories were run. Trajectories were run for every week totaling in 52.258 weeks per year for the years 2006, 2007, and 2008. 59 trajectories were run for 2006, 58 for 2007, and 60 for 2008. 63 trajectories fell into category 1 designation with 22 in 2006, 18 in 2007, and 23 in 2008 (Table 1). 59 trajectories were given a category 2 designation with 25 in 2006, 13 in 2007 and 21 in 2008 (Table 1). Category 3 designated trajectories totaled 55. Category 3 subcategory (a): low altitude start, totaled 11, with 1 trajectory in 2006, 6 in 2007, and 4 in 2008 (Table 1). Category 3 subcategory (a): high altitude start, totaled in 8 trajectories with 2 in 2006, 5 in 2007, and 1 in 2008 (Table 1). Category 3 subcategory (b) had 36 trajectories designated, with 9 in 2006, 16 in 2007, and 11 in 2008 (Table 1).

Table 1 HySplit backward trajectories totals, categorical designation and year

Trajectory Designation	Category 1	Category 2	Category 3a: low altitude start	Category 3a: high altitude start	Category 3b
2006	22	25	1	2	9
2007	18	13	6	5	16
2008	23	21	4	1	11

Results show reoccurring potential sources located in the Northeastern United States, Nova Scotia, Northern United Kingdom, and the Scandinavian Peninsula (Figure 3). Out of the trajectories designated category 3 (a): low altitude start, ~45.45% began in the Northeastern United States, ~18.18 % beginning in Nova Scotia, the Northern United Kingdom, and the Scandinavian Peninsula (Table 1). Northern central Russia was a reoccurring starting point for air trajectories in category 3 subcategory (b): high altitude start.

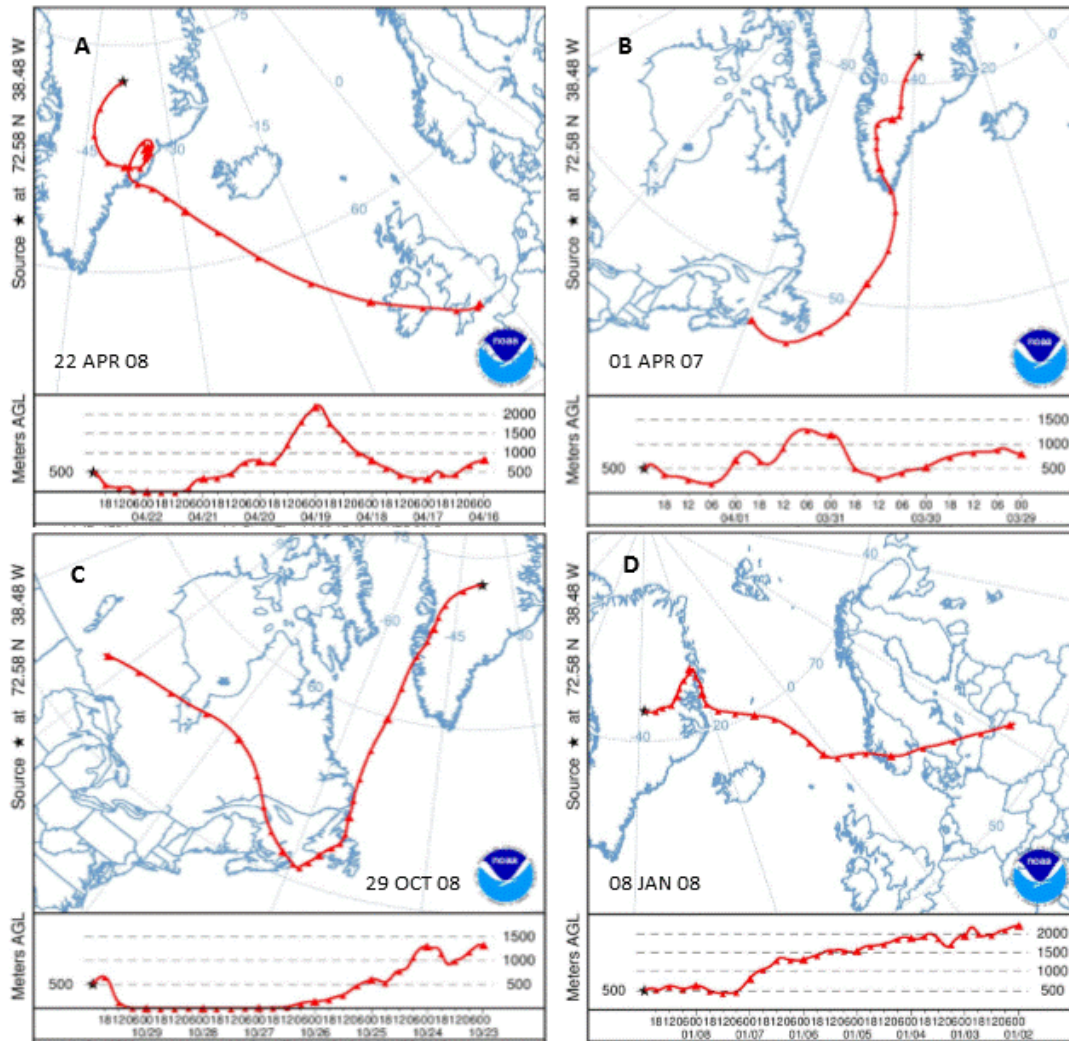


Figure 3 Backward trajectory Output from HySplit of Possible Source Areas of BC. The starting point for the trajectory is Greenland Summit Station with a 168 hour backwards trajectory ending in the location of the starting air mass. Bottom graph provides the altitude of the air mass in meters.

Major deposition events occurred in early to mid-2006, 2007 and 2008 (Table 2). These large in situ measurements coincided with trajectories that started with low altitude winds over populated land masses. The largest deposition events within the three years occurred within early-2008 according to an analysis of the meteorological snowfall record comparison with in-situ data (Table 2).

Table 2 Excerpt from in-situ data highlighting large deposition event in in-situ measurements for Greenland 2008 from Doherty and Warren (2008)

entry	Region	newly fallen snow =1; snow=2, melting snow =3, sea ice=4, uncertain=9	Year	Month	Day	Lat N	Lon E	sample depth, top (cm)	sample depth, bottom (cm) (0=surface sample)	fraction of total snowpack depth (n/a = 9)	fraction non-BC absorption (999=n/a)	Absorp. Angstrom exponent (450:600nm)	equivalent BC (ng/g) (999=n/a)	maximum BC (ng/g)	estimated BC (ng/g)
337	Greenland	2	2006	8	7	79.878	333.991	0	3	9	0.4	2.22	26.6	19	15.9
339	Greenland	2	2006	8	7	79.878	333.991	0	3	9	0.34	1.97	43.4	33	28.9
342	Greenland	2	2006	8	7	79.878	333.991	30	40	9	0.38	2.16	15.6	11	9.7
354	Greenland	2	2007	4	27	63.149	315.183	0	0	9	0.4	2.02	10.8	8.2	6.5
370	Greenland	9	2007	7	9	76.402	291.943	0	10	9	0.53	2.62	11.1	7.3	5.2
374	Greenland	9	2007	7	9	76.415	292.261	0	10	9	0.48	2.44	12.2	8.4	6.4
377	Greenland	2	2008	5	3	66.481	313.72	0	0	9	0.55	2.75	12.4	7.8	5.6
378	Greenland	2	2008	5	5	69.898	313.086	0	0	9	0.42	2.23	13.4	9.7	7.7
380	Greenland	3	2008	7	24	66.474	313.72	2	4	9	0.35	1.94	21.3	16	13.8
381	Greenland	9	2008	7	24	66.474	313.72	4	7	9	0.4	2.12	15.3	11	9.2
403	Greenland	3	2008	7	25	65.952	313.567	7	9	9	0.3	1.76	16.3	13	11.5
404	Greenland	3	2008	7	25	65.952	313.567	9	10	9	0.33	1.92	34.2	26	22.8
405	Greenland	3	2008	7	25	65.952	313.567	10	11	9	0.4	2.13	26.1	18	15.7
406	Greenland	3	2008	7	25	65.952	313.567	10	11	9	0.39	2.12	26.6	19	16.2
407	Greenland	3	2008	7	25	65.952	313.567	11	13	9	0.41	2.18	21.6	15	12.8
408	Greenland	3	2008	7	25	65.952	313.567	11	13	9	0.41	2.19	15.6	11	9.2
409	Greenland	9	2008	7	25	65.952	313.567	13	14	9	0.42	2.22	17.5	12	10.1
430	Greenland	3	2008	7	26	66.22	313.654	9	11	9	0.38	2.09	24.7	19	15.3
431	Greenland	3	2008	7	26	66.22	313.654	9	11	9	0.43	2.24	16.1	12	9.2
432	Greenland	3	2008	7	26	66.22	313.654	11	14	9	0.44	2.28	14.8	11	8.3
433	Greenland	3	2008	7	26	66.22	313.654	11	14	9	0.45	2.3	11.6	8.2	6.4
443	Greenland	9	2008	7	26	66.22	313.654	53	61	9	0.41	2.18	2.1	1.6	1.3

Deposition event frequency increased during the first six months of the year. Trajectories that began in the later part of the year from land mass versus open sea tended to start at around 1000 to 1500 m. The height of these early trajectories makes them unlikely to have carried aerosols.

No large forest fires were noted during a search for large biomass burning events that aligned with trajectories that began with low altitude air masses. Industrial processes were

found within 50 km of trajectories that originated in the North Eastern United States and the United Kingdom, and to a lesser extent, Nova Scotia and the Scandinavian Peninsula.

According to annual wind roses, winds in 2008 are strongest from the SE and S followed by the NE (Figure 5). Similar patterns were seen in 2006, and 2007 wind rose data.

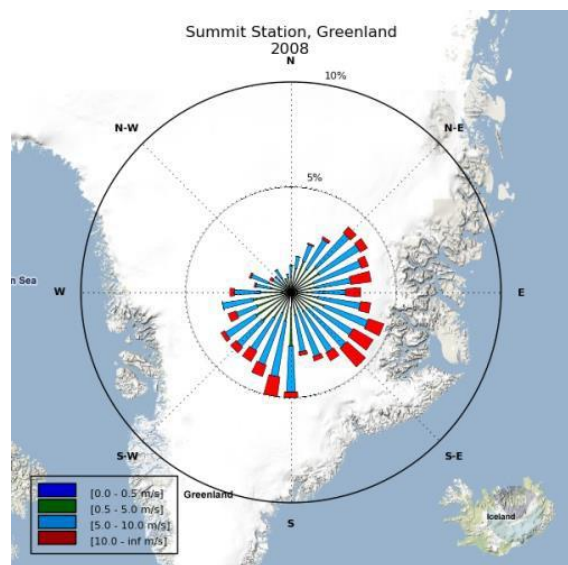


Figure 5 Annual Wind Rose for Summit Station, Greenland 2008 from ESRI NOAA

Discussion

According to the trajectory analysis, given a week's lifetime in the atmosphere, if particles were injected higher into the atmosphere due to local convection currents, Northern Russia, and the Scandinavian Peninsula could be possible sources, or finally, there could be an injection from shipping in the region. Northern central Russia was a reoccurring starting point for air trajectories in category 3 subcategory (b): high altitude start. However, because the air mass was at a high altitude (<1000 m) at the beginning at the week, it is an unlikely source of BC and was dismissed. On the Scandinavian Peninsula air trajectories originating in the region reoccurred four times during the 2006-2008 period. Air trajectories began with low altitudes and may have been a possible source of BC. While the country of Norway has one of the highest air quality standards in the world, however because the analysis was done from 2006-2008 this may have been prior to standards or variance in the areas industrial areas. Since industrial processes, coal power plants and steel manufacturing, were found within 50 km of trajectories that originated in the North Eastern United States and the United Kingdom, and to a lesser extent, Nova Scotia and the

Scandinavian Peninsula, industrial processes account for the most likely source of BC for the 2006, 2007, and 2008, time period. Within the United States and Nova Scotia, coal burning power plants were the most common industrial sources noted in the regions where low altitude air masses were modeled to have begun.

Shipping emissions as a source of BC to Greenland may be a possibility due to an increase in shipping in the Arctic in the last 20 years. Emission factors for shipping were not considered for this study due to time and resource constraints.

The analysis was limited due to time and access to in-situ and meteorological data for daily trajectories. Conclusions drawn from this study can be extrapolated to give a general understanding of the variability of trajectories of BC into the Greenland Ice Sheet (GIS) area and potential sources, but further in-depth analysis needs to be done for other study areas to be more representative of GIS as a whole.

Conclusion

BC from thousands of miles away have a direct impact on snow and ice in the Arctic via long-range transportation and deposition events. Sources of black carbon can be identified utilizing air trajectory models. By understanding the direction and strength of prevailing winds that carry aerosols such as BC into the Arctic, we can begin to narrow down locations and source types of BC from the temperate regions. Industrial processes and coal burning power plants were located in many of the source regions identified by this study. Knowing the sources of BC affecting the Arctic may be important in future mitigation policies by countries around the globe. As climate change continues, monitoring ice melt rates and the rate of deposition of BC on snow and ice covered areas will become increasingly important.

To complement this study, future research should include more in-depth analysis with daily backward trajectories and seasonal wind rose data. Analysis of the years since 2008 to present a more up to date idea of what the deposition rates are currently. Shipping emissions are an increasingly important factor to the aerosol rates in the Arctic but were largely left out of this study due to time and resource constraints.

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**The Impacts of Microaggressions on the Performance of Multiracial
and Monoracial College Students**

By

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Faculty Mentor: Cece Ridder, PhD

Citation: Keith, J. The Impacts of Microaggressions on the Performance of Multiracial and Monoracial College Students. Portland State University McNair Scholars Online Journal, Vol. 10, Year 2016.

Abstract

This study attempts to contribute to the research on how microaggressions affect performance of multiracial and monoracial college students in both social and academic realms. Data on microaggressions was collected through online surveys distributed via email to several hundred students. Participants consisted of students over the age of 18 at an urban institution in the Pacific Northwest. Bivariate logistical regression and axial coding were used to analyze participant responses. The first hypothesis for this study is that multiracial college students experience more microaggressions in social settings, while monoracial students experience more microaggressions in academic settings. The second hypothesis is that multiracial students experience privilege in academic settings, while monoracial students experience privilege in social settings. The final hypothesis is that the shade of skin tone of participants impacts their experiences with privilege, as well as their experience of microaggressions. Researchers found that multiracial students have a higher likelihood of experiencing microaggressions in a social setting and people with darker skin tones have a higher likelihood of experiencing microaggressions in an academic setting.

Keywords: multiracial, monoracial, campus setting, social setting, microaggressions

Introduction

Problem

College students face many adversities that may impact their success, one of which is microaggressions. For the purpose of this study, microaggressions will be defined as "...brief and commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults..." (Sue, Capodilupo, Torino, & Bucceri, 2007, pg. 271). While microaggressions are a relatively recent topic examined in the psychological community, it is growing in popularity in others as well, such as counseling and education. However, there is a lack of research and understanding on how microaggressions affect the success of both multiracial college students, people who identify as more than one race, and monoracial college students, people who identify as one race. Many factors can influence the types of microaggressions that a student may experience, as well as influence the impact on the student. These factors may include: gender, sex, age, and ability, although one of the most important factors is racial identity. Racial identity is the degree to which one identifies as a member of a particular racial group. For example, African Americans typically identify as "black" and see themselves as members of the black community. Identifying as a member of a community can be important to the development of one's self-esteem because intergenerational relationships are formed, allowing people to be influenced in their personal development of their own identity.

For many people, college is a time for self-exploration and is a place where identities develop. This is especially true for students of color or students with multiracial backgrounds because many multiracial students experience their race in a different ways than how monoracial students perceive their racial identity. Many monoracial people expect multiracial people to pick one race or ethnicity to claim. However, many multiracial people

cannot pick one identity to claim because they feel that claiming only one identity is not being true to who they are and that being multiracial is a unique identity in itself. According to Ingram, Chaudhary, and Jones (2014), "how one identifies themselves and is identified by others can impact biracial students' college experience and the groups to which biracial students interact" (p.297). College can be a time for multiracial students to accept being multiracial as its own unique identity. Although for many students this is a positive thing, it also comes with a unique form of oppression that is typically subtler.

Past research has examined various topics involving multiracial college students and their relationships with microaggressions, which will be discussed in depth in the literature review section. They have found that multiracial identities impact interpersonal relationships. For example, multiracial students typically surround themselves with other multiracial people or they migrate between racial groups. Research has also found a connection between racism and a decrease in physical and mental health which can become present more prominently during the college years for students because that is often the age in which symptoms begin to show. They have also examined microaggressions in universities. For example, Harwood, Hunt, Mendenhall, and Lewis (2012) examined racial aggressions experienced by students of color in residence halls at a predominantly white institution, however they only focused on one portion of the university setting rather than examining other settings in which racial aggressions can take place. Researchers have also examined coping mechanisms of African American women who experienced microaggressions. Although most studies were qualitative, Nadal (2011) developed the Racial and Ethnic Microaggressions Scale (REMS), which was the first scale to measure microaggressions, and has been found to be an effective form of measurement.

Microaggressions are important to examine because they also can have a negative impact on the academic self-concept of college students. However, researchers tend to overlook microaggressions and instead focus more on overt racism, which is far less

common in our current society and culture. This limited research on microaggressions leaves gaps in information. For example, past research has failed to examine microaggressions in regards to the performance of multiracial and monoracial college students across multiple fields. Additionally, researchers failed to make comparisons of various racial and ethnic groups which does not allow people to examine how each racial group is affected and how that may differ for each group.

Research Question and Hypotheses

This study examines how microaggressions affect the performance of multiracial and monoracial college students in social and academic realms to add to understanding of how interpersonal interactions impact self-esteem. This study examines how frequently microaggressions occur in academic and social settings, as well as who the perpetrators of these microaggressions are. Also, this study examines the regularity in which microaggressions occur and the reactions that people have to them. There are various hypotheses for this study. First, monoracial students experience more microaggressions in academic settings, while they experience privilege in social settings. Multiracial students experience more microaggressions in social settings, while they experience privilege in academic settings. Finally, the experience of microaggressions as well as the impact that they have on students will be influenced by participants' shade of skin tone.

Literature Review

A review of the literature suggests that microaggressions play a large role in the experience of students in college and that faculty should be more proactive in responding to microaggressions. In a recent study of college students of color at a Predominantly White University, Harwood, Hunt, Mendenall, and Lewis (2012) examined students' experiences in terms of racial microaggressions. Researchers conducted semi-structured interviews with open-ended questions about experiences related to discrimination, in which questions

mostly came from Sue et al. (2007a), as Sue was one of the researchers to lay a foundation for studying microaggressions. Coding via line-by-line analysis was used to determine themes and categories from the data. Researchers found three different forms of microaggressions including "microassaults (verbal or nonverbal behavior aimed at hurting someone) , microinsults (subtly demeaning snubs or dismissive looks and gestures that are often unconscious), and microindividualizations (minimizing or denying the racialized experiences of people of color)" (Harwood, 2012, p.164). There were two main manifestations of racial microaggressions: "individual-level racial microaggressions and environmental racial microaggressions" (Harwood, 2012, p.164). The main themes that occurred included: racial jokes and verbal comments, racial slurs written in shared spaces, and segregated spaces and unequal treatment.

In another study, researchers Harwood et al. (2012) examined the experiences of students of color in a predominantly white university through focus groups and interviews. They found that students of color experienced microaggressions from peers in the residence halls and university staff made students feel invalidated. Harwood et al. (2012) concluded that university housing departments should examine their educational mission and manage the perceptions of the department. University administration can be more involved in supporting diverse interactions by providing training for staff and students about racial microaggressions. There are several limitations with this study. This study only focused on one predominantly White institution in the Midwest and only one setting on campus. The authors called for future research that examines how students of color respond to microaggressions and how strategies vary for groups as well as individuals. This research only used qualitative methods and did not examine the range of student development.

Similar conclusions were found in a study by Boysen & Fredonia (2012), which examined students' and teachers' perceptions of microaggressions, as well as how microaggressions could be managed. Boysen and Fredonia (2012) used surveys to collect

data from participants, which measured perceptions of microaggressions by using various scales. Instructors' surveys also included a yes/no portion about whether they would respond to various scenarios. There were three different analyses completed: perceptions of microaggressions, responding to microaggressions, and gender as a possible confound. Analysis of variance (ANOVA) was used to analyze teachers' and students' perceptions of microaggressions in the classroom. Chi square analysis were used to determine the beliefs about appropriate or inappropriate responses to microaggressions. Logistic regression was used for the final analysis for exploring gender as a possible confounding variable. Three of the four hypotheses were confirmed. That is, instructors of diversity courses were more likely to respond, viewed microaggressions more negatively, and did not view ignoring the microaggression as an efficient response. The only hypothesis that was not confirmed, found the opposite to be true. Teachers' ratings of effectiveness were found to be significantly lower than students'. There were various limitations of this study. The samples were lacking racial diversity because participants were primarily from the same racial background so, there was no way to tell if the results would differ for students with an ethnic and racial minority background. Another limitation is the descriptions of the microaggressions and the measurement of effectiveness. The research would have been more effective if it had simulated scenarios with microaggressions so actual responses could be viewed. The study did not allow for an origin of differences in microaggression perceptions.

Hunt (2014) examined how student experience was impacted by microaggressions and how that affected their overall experience on campus. Hunt (2014) concluded that each student has a unique experience and that experience should be respected as well as embraced. This research was qualitative and used semi-structured interviews. The research found that students felt that most monoracial people on the college campus did not take the time to understand the experience of being multiracial. Due to time constraints, the

researcher was limited in their number of participants and were unable to recruit from other universities, thus the findings may not be generalized outside of this sample. Hunt (2014) suggests that people get to know their own biases, provide resources specifically for multiracial students, as well as create inclusive spaces to better support multiracial students on college campuses.

Methods

Participants

Participants in this study consisted of students from a large urban university in the Pacific Northwest. Participants consisted of traditional freshmen to fifth year seniors and nontraditional students. Nontraditional students are students who either returned to college after taking a period of time away from college or students who are older and did not start college at 18 years old. Participants were sent an email inviting them to participate in the study. Faculty members were also forwarded the request for students to participate. There were a total of 66 respondents, 17 identified themselves as female and 11 identified themselves as male. Some participants declined providing information about their racial identity and gender identity as not all survey questions were required. The age of participants ranged from 18 to 64. Ten participants identified as multiracial while 50 identified as monoracial. Out of those who responded, 61% stated that they were first generation students; neither parent has earned a four-year (Bachelor's) degree. Most students in this study had a grade point average of 3.1-3.5 on a 4.0 scale.

Measures

A survey was used to collect data and was made available in various formats. The survey consisted of both multiple choice questions, as well as open-ended questions. Multiple-choice questions were assigned numbers to allow researchers to code answers and open-ended questions were also coded for themes. Demographic questions were asked in

beginning of the survey. Questions addressed experiences related to microaggressions in social and academic settings. For example, researchers asked about frequency of experiencing microaggressions, as well as participants' reactions to those experiences. A portion of Nadal's (2011) Racial and Ethnic Microaggressions Scale (REMS) was also used. All questions on the survey were voluntary, except whether or not participants agreed to the informed consent.

Table 1: Frequency Analysis Results

Question	I did not experience this event in my time at PSU	I experienced this event 1-3 times	I experienced this event 4-6 times	I experienced this event 7-9 times	I experienced this event 10 or more times	Total Responses	Mean
A faculty/staff or student was unfriendly or unwelcoming toward me because of my race	31	8	1	0	1	41	1.34
My opinion was overlooked in a group discussion because of my race	27	10	1	1	2	41	1.56
I was ignored at school or at work because of my race	29	7	2	0	2	40	1.48
Someone assumed that my work would be inferior to people of other racial groups	26	6	4	2	2	40	1.7
A faculty/staff or student treated me differently than monoracial peers	31	4	3	1	1	40	1.43

Procedure

Participants received emails from researchers and forwarded emails from faculty asking them to voluntarily participate in an online survey. The link to the survey was posted on Facebook (personal accounts and accounts from various departments around campus) for students to complete and paper copies of the survey were available to students in various locations around campus. Surveys included an informed consent form, as well as the purpose of the study. Axial coding was used to analyze open-ended questions. Logistic regressions were used to test the hypotheses. Bivariate logistical regression in SPSS was used to analyze close-ended questions on the survey to test the hypotheses.

Results

The bivariate logistical regression determined that racial identity, being monoracial or multiracial, did not determine whether students would experience microaggressions in an academic setting. That is, there was not a statistically significant relationship between racial identity and microaggressions in an academic setting. However, participants who indicated that they were multiracial had a greater likelihood of experiencing microaggressions in a social setting. That is, there is a significant relationship with microaggressions in a social setting ($p=.021$) with odds ratio of 4.545. There was not a statistically significant

Table 2: Bivariate Logistic Regression Predicting Microaggressions in Social Settings

Predictor	B	Wald	P	Odds Ratio
Racial Identity	1.51	5.32	0.021	4.54

Bivariate Logistic Regression Predicting Microaggressions in Academic Settings

Predictor	B	Wald	P	Odds Ratio
Skin Tone	1.208	7.48	0.006	3.34

Note : Only significant results are included in this table.

relationship between skin tone and microaggressions in a social setting. Skin tone is statistically significant ($p=.006$) in an academic setting with an odds ratio of 3.347. People who have a darker skin tone have a higher likelihood of experiencing microaggressions on campus.

Most respondents reported that they had not experienced microaggressions from faculty or staff. When asked how many times respondents experienced a microaggression in an academic setting, 43.9% indicated "I did not experience this event," 28.1% indicated "I experienced this 1-3 times," 19.3% indicated "I experienced this 4-6 times," 1.8% indicated "I experienced this 7-9 times," and 7.0% indicated "I experienced this event 10 or

Table 3: Percentages of Microaggressions Experienced in an Academic Setting

Question	I did not experience this event in my time at PSU	I experienced this event 1-3 times	I experienced this event 4-6 times	I experienced this event 7-9 times	I experienced this event 10 or more times	Total Responses	Mean
How many times have you experienced a microaggression in an academic (classroom, study space, etc.) setting at							

PSU?	43.86%	28.07%	19.30%	1.75%	7.02%	57.00%	2.00%
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more times.” Fifty-eight percent of respondents felt that they had not experienced microaggressions in social settings. Forty-nine percent of participants expressed that they felt they did not experience privilege in social settings while 54% felt that they experienced privilege in academic settings.

Most respondents reported that they did not experience a microaggression in a social setting. When asked how many times they experienced a microaggression in a social setting, 40.4% responded “I did not experience this event,” 21.2% stated “I experienced this event 1-3 times,” 15.4% responded “ I experienced this event 4-6 times,” 15.4% stated “I experienced this event 7-9 times, ” and 7.7% responded “I experienced this event 10 or more times.” Sixty-three percent of respondents feel that if they have experienced microaggressions, they feel it is attributed to race. Fifty-three percent of respondents do not believe that microaggressions they experienced are attributed to skin tone.

Table 4: Percentages of Microaggressions Experienced in Social Settings

Question	I did not experience this event in my time at PSU	I experienced this event 1-3 times	I experienced this event 4-6 times	I experienced this event 7-9 times	I experienced this event 10 or more times	Total Responses	Mean
How many times have you experienced a microaggression in a social setting?	40.38%	21.15%	15.38%	15.38%	7.69%	52.00%	2.29%

When asked, “How likely are you to respond to a microaggression in general?” 17% indicated “very unlikely,” 12.2% indicated “unlikely,” 4.9% stated “somewhat likely,” 9.8% were undecided, 24.4% indicated “somewhat likely,” and 22% stated “likely.” The majority (63%) of participants identified that their racial identity does not differ from other people’s perception of their identity. After experiencing microaggressions, most (60%) of participants reported that they do not feel differently about themselves. The majority (79%) of people also indicated that they do not go out of their way to dress or look a certain way to counteract a specific stereotype.

The open-ended portion of the survey revealed that 49% of respondents experienced microaggressions, in general, related to race, gender, sexual orientation, socioeconomic status, and appearance while 51% stated that they do not experience microaggressions. Respondents indicated that microaggressions they experienced were mostly related to gender. The most common feelings respondents shared after experiencing microaggressions from peers as well as faculty and staff, were annoyance and anger. The most common example given of a microaggression experienced in an academic setting was having someone be surprised by the respondent's achievement as well as having someone make an assumption about a gender stereotype. The most common examples of microaggressions experienced in a social setting were:

- Gender stereotyping
- Implying gender stereotypes around queer identity
- Surprised by achievement
- Being asked, "what are you?"
- Being told how to identify

Participants feel that race and gender are the ways in which they experience privilege in both social and academic settings, for example being Caucasian and male.

Discussion

This pilot study tested three hypotheses about the performance of multiracial and monoracial students in social and academic settings. The first hypotheses stated that monoracial students experience more microaggressions in academic settings, while they experience privilege in social settings. The second hypothesis stated that multiracial students experience more microaggression in social settings while they experience privilege in academic settings. Both of these hypotheses were found to be partially true because there is not a statistically significant relationship between race and microaggressions in an

academic setting, although racial identity is significant in a social setting. This result is not surprising due to the demographics of the university at which the study took place, which is a predominantly White university. Many monoracial people who identify as Caucasian do not experience microaggressions around racial identity because they are considered part of the majority. People often experience microaggressions around identities that give them minority status. For example, a white male might still experience microaggressions if they identify as homosexual as well because their identity as a queer person is of minority status. Fifty-four percent of respondents indicated that they experience privilege in an academic setting while 49% indicated that they experience privilege in a social setting, although it is unclear which racial groups respondents identify as. Students may have reported experiencing privilege in academic settings because they are all college students and there is privilege associated with being able to attend a college or university. The last hypothesis stated that the experience of microaggressions as well as the impact they have on students would be influenced by the shade of skin tone that participants have. This hypothesis was found partially true as well because skin tone does not have a statistically significant relationship with microaggressions in a social setting, however is significant in an academic setting. Microaggressions, privilege, and performance are difficult topics to measure and instruments should be examined further in future research. The general trend in the data shows that students at this urban university in the Pacific Northwest are experiencing microaggressions, however the majority of microaggressions experienced are related to other identities than race. The trend of the data makes sense when considering that the majority of participants were monoracial, specifically white, and identified as female.

This study does have limitations, although it offers a unique perspective on microaggressions in social and academic settings. The most important limitation is a lack of diversity in this sample because only one predominantly white institution in one part of the

country was examined. The results of this study may not be able to accurately represent the experience of multiracial and monoracial students across the United States without looking at universities in other geographical locations. The hypotheses may have been proven true if this research was conducted at a more diverse campus, such as a historically black college or university. Another limitation was the amount of participants ($n=66$). This small sample limited the types of analysis that could be done. A larger sample could give an accurate representation of the population. Future research should include a more diverse and larger sample to gain a better understanding of microaggressions across various racial identities. Also, future research should include multiple universities in different geographical locations to examine whether the experience of microaggressions differs based upon environments, cultures, etc.

Another important limitation of this study is that it primarily relied on self-reporting, which can allow for responder bias. Self-reporting can also be problematic specifically in relation to microaggressions because many people do not know the term. People may be experiencing microaggressions without having the terminology to describe what they are experiencing. People may not be able to think of a time in which they experienced a microaggression because microaggressions are subtle. Also, a limitation of this study is that it examined a university setting, which only allowed researchers to examine college students. Future research could examine adults in a workplace setting because the average adult spends a significant amount of their time in the workplace. This research did not have a second coder to account for researcher bias. Another important limitation of this study is that researchers were unable to carry out a mixed methods procedure as they originally intended to. Researchers were planning to include interviews because most past research has been qualitative, however there were not enough multiracial respondents willing to participate in interviews. Future research should include mixed methodology because it would increase the external validity of the project, which would make it more generalizable

to other college campuses. Mixed methodology also allows researchers to gain a better understanding of participant experiences because participants are not limited by the structure of the survey. Despite all the limitations, this study yielded several interesting findings.

Conclusion

In summary, this study describes how microaggressions affect the performance of multiracial and monoracial college students on an urban campus. The majority of students in this sample experience microaggressions in relation to identities other than race, such as age, gender, sexual orientation, ability, etc. This study offers a foundation for research examining microaggressions in various settings. Although, the hope is that this study brings awareness to microaggressions, as they are a newly examined topic in psychology because microaggressions are still a form of racism, although they are subtle. Many people feel that racism is no longer an issue in today's society because it is less overt. However, it is still an issue that needs to be addressed by informing people that microaggressions exist, which can lead to cultural competency training for staff and students, as well as creating multiracial specific resources for students.

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THE OTHER LIVES OF RIBOSOMAL PROTEINS

By

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Abstract

Cellular mRNAs are produced in the nucleus and exported to the cytoplasm through nuclear pore complexes (NPC) that are found in the nuclear membrane. The correctly processed mRNAs are exported in the form of messenger ribonucleoproteins (mRNPs). Since the NPC allows the passage of only one mRNA molecule at a time, export of large ribonucleoproteins (megaRNP) found in the nucleus cannot be transported through the NPC. However, a recent study has discovered an alternative export mechanism known as nuclear envelope budding, which allows megaRNP granules to be exported. This study particularly focuses on identifying ribosomal proteins (RPs) found within large RNA granules within the salivary gland, and neuromuscular junction (NMJ) of *Drosophila melanogaster* larvae. Although, RPs are known mainly for playing an essential role in ribosome assembly and protein translation that occurs in the cytoplasm, recent discoveries have shown that ribosomal proteins possess ribosome-independent functions, which are essential for a cell survival and proper animal development. This study finds that Rps3 is possibly localized within large RNA granules within NMJ of *Drosophila* larvae; however, the future in-depth studies are needed to verify this finding and identify the specific function of Rps3 in the megaRNP granules.

Keywords: Biology, Ribosomes, Ribosomal Protein

Introduction

Inside every eukaryotic cell the transcription of mRNA occurs in the nucleus, which makes the translocation of mRNA across the nuclear envelope (NE) through nuclear pore complex (NPC) a critical determinant of proper gene expression and cell survival. Historically, the translocation of mRNA to the cytoplasm has been thought to occur only through nuclear pore complexes (NPC) that are found in the nuclear membrane. This transport is mediated by transport receptors that shuttle between the nucleus and cytoplasm, which provide the means for RNAs to enter and exit an otherwise impermeable capsule (Nakielny et al., 1997; Conti et al., 2001). Recently, however, significant advances in our understanding of the mechanism of mature RNA export between the nucleus and the cytoplasm have been made. Our understanding of mRNP export from the nucleus into the cytoplasm has been advanced by the discovery of nuclear envelope budding which permits large ribonucleoprotein particles (RNPs)/megaRNPs to be exported from the nucleus. In this pathway, the granules exit the nucleus by passing through the nuclear membranes. Granules are enveloped by the inner nuclear membrane, which pinches off into the perinuclear space, and then fuses with the outer nuclear membrane and finally exit the nucleus (figure 1) (Speese et al., 2012). MegaRNPs are transport granules that contain many mRNAs assembled with RNA-binding proteins, RPs for small and large subunits of ribosomes and translation initiation factors that are transported to sites of translation (Anderson et al., 2006; Khandjian et al., 2009).

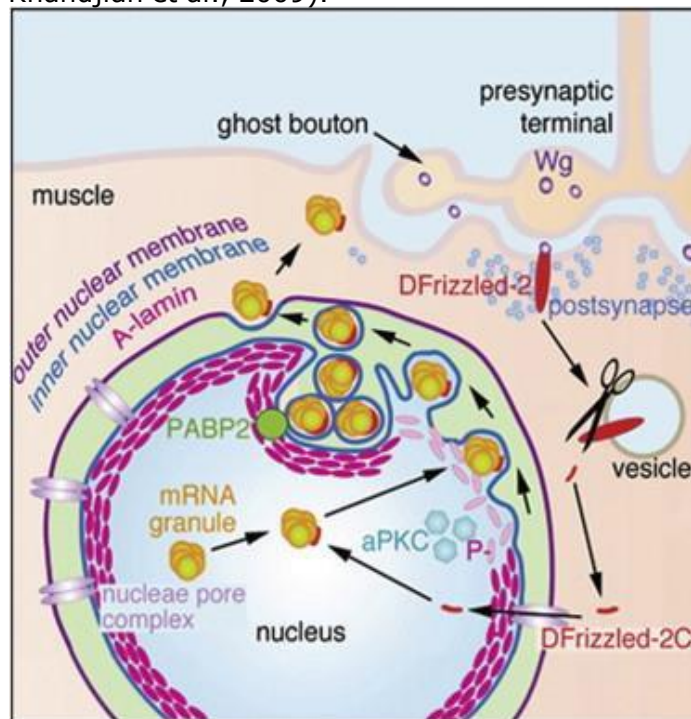


Figure 1. Nuclear Envelope Budding in Drosophila Muscle Cells

Another critical determinant of proper gene expression and cell survival is the presence and proper function of all 79 RPs that are found within eukaryotic ribosome (Zhou et al., 2015). Ribosome is a complex molecular machine that is primarily responsible for

translation and protein synthesis from messenger RNA (mRNA). Ribosomal proteins (RPs) are major components of the ribosome and play a significant role in the initiation, elongation, or termination phase of protein translation (Wang et al., 2014; Nissen et al., 2000). Therefore, this indicates that ribosomal proteins are essential for both ribosome formation and protein translation. However, growing evidence has suggested that some ribosomal proteins have functions distinct from their role in the ribosome and protein synthesis (Wool, 1996; Warner and McIntosh, 2009). In some instances, their regulatory functions are so significant that mutations in specific ribosomal protein genes (RPGs) can lead to specific physiological defects in eukaryotic organisms. For example, one study showed that mutations of the ribosomal protein L38 (Rpl38) gene in mice exhibit tissues specific patterning defects, particularly, homeotic transformations of the axial skeleton in Rpl38 mutant embryos (Kondrashov et al., 2012). This study also demonstrates that Rpl38 plays a critical role for translational control of Hox gene expression, which is required to establish the mammalian body plan. Similarly, deletion and mutation of multiple RPs in zebrafish has demonstrated a variety of physiological defects as well as increase in the incidence of peripheral nervous system tumors (Amsterdam et al., 2004). In addition, functional studies of some mutant mammalian RPs, have linked mutations in a number of RPs to congenital birth defects such as Diamond–Blackfan anemia (Lipton and Ellis, 2010). Therefore, the existence of tissue specific physiological defects suggests that some RPs indeed have functions independent of the ribosome. In the context of the present study, the screening for potential RPs found within large RNA granules reveals enrichment of Rps3 within mega RNPs in postsynaptic muscle nuclei.

Materials and Methods

Fly Strains

Fly cultures and crosses were grown on standard fly medium at 25°C. w+/-; w;t; HS-UAS-GAL4 strains for salivary glands and w+/-; ;Mhc UAS-GAL4 strains for NMJ were used. In this case, HS-gal4 and Mh-gal4 were used to drive UAS controlled transgenes encoding ribosomal proteins fused to HA and GFP tags.

Dissection

For the NMJ analysis, w+/-; ;Mhc UAS-Gal4 larvae grown at 25°C were used. *Drosophila* larvae were carefully dissected using Jan's Saline without CaCl₂. A longitudinal mid-dorsal incision was made and the edges of the tissues were pinned so that the preparation was spread out on a glass slide in the preparation dish. All the internal organs were carefully removed while leaving the body wall intact, particularly the ventral longitudinal muscles. Consequently, the dissected larva was fixed in 4% paraformaldehyde for 20 minutes. The dissected larva was then washed three times with 0.2% TritonX-100 in 1X (PBS-TX). The larva was then transferred into a glass dish containing 1x PBS, 0.2% Triton X.

For salivary glands analysis, w+/-; w;t; HS UAS-Gal4 larvae grown at 25°C were used. The tip of the mouth hooks were grasped with one pair of forceps, while holding the body about 2/3 of the way down with the other pair. The mouth hooks were pulled and the salivary glands were exposed. The salivary glands were dissected using Jan's Saline in 0.5 CaCl₂. Next, the salivary glands were fixed in 4% formaldehyde for 25 minutes. The dissected larvae were then washed three times in 1x PBS, 0.2% Triton X. The larvae were then transferred into a glass dish containing 1x PBS, 0.2% Triton X.

Immunohistochemistry

Primary antibody master mixes were prepared at the following concentrations, diluting the antibody in 1x PBS, 0.2% Triton X:

LamDm0- stained with α -LamDm0 primary (1:100)

FlyORF - 3xHA tagged stained with α -LamDm0 (1:100) and α -HA (1:250) primaries

Secondary antibody master mixes were prepared at the following concentration, diluting the antibody in 1x PBS, 0.2% Triton X:

α -Ms 647 secondary (1:400); Con A 594 (1:200) to NMJ only

FlyORF-3xHA tagged: α -Ms min-x Rat 488 (1:400); α -Rt min-x Ms 549 (1:400)

400 μ L of primary antibody solution was dispensed to each well. Then, the dissected larvae were incubated in primary antibody at 4°C overnight. The dissected NMJ were then washed three times for 15 minutes in 1x PBS, 0.2% Triton X at room temperature. Similarly, the dissected salivary glands were washed three times for 30 minutes in 1x PBS, 0.2% Triton X.

400 μ L of secondary antibody solution was dispensed to each well. Then, the dissected larvae were incubated at room temperature for 2.5-3 hours. Finally, they were washed 3 x 30 minutes in 1x PBS, 0.2% Triton X.

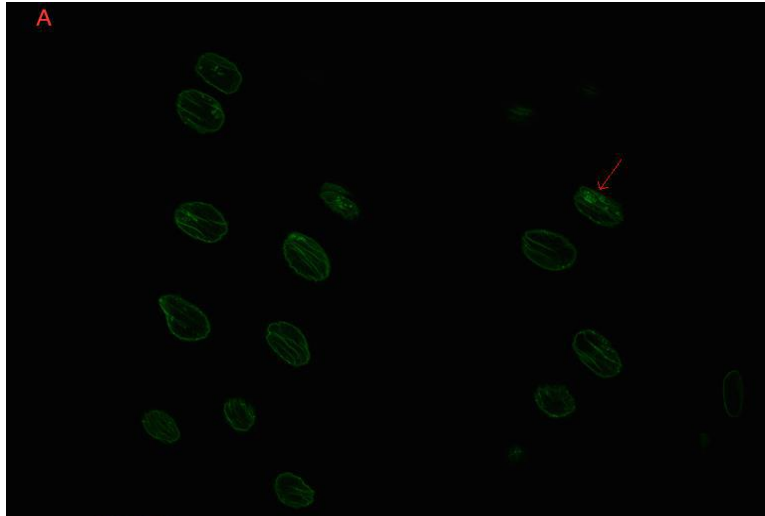
Mounting

The head and tail of dissected NMJ were removed with a fresh razor blade on the processing glass slide. The dissected NMJ and salivary glands were transferred to the glass well of a dissection dish and the wash solution was carefully removed with a pipette. A drop of Vectashield was then dispensed onto the salivary glands and NMJ. They were then carefully transferred from the dissection dish to microscope slides. Each microscope slide contained 3-4 larva for NMJ dissection and 10-12 for the salivary glands. The samples were aligned and oriented so that ventral longitudinal muscles were facing up. Small drops of Vectashield were added once all the samples were oriented and covered with coverslip. The coverslip was sealed around the border with a layer of CoverGrip and dried at room temperature overnight.

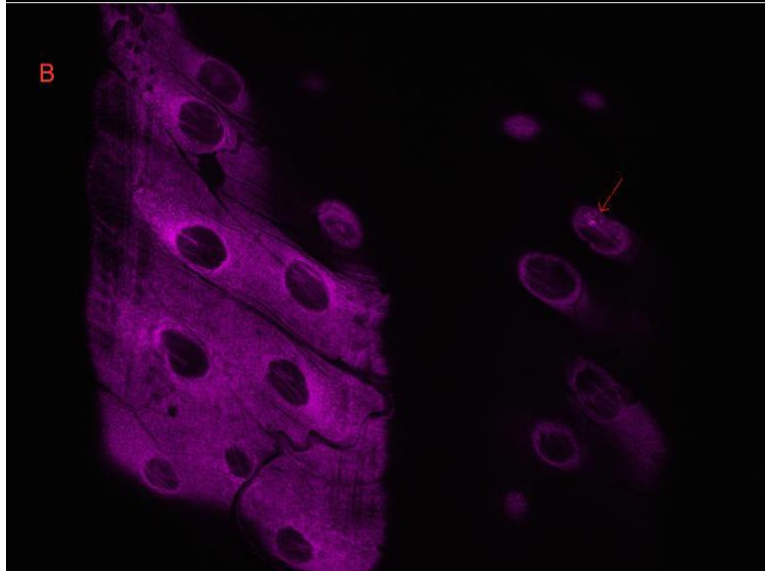
Confocal Microscopy

The images of dissected NMJ and salivary glands were taken on a Zeiss confocal LSM 7.0 microscope using a 40X oil immersion lens. For the NMJ and salivary glands staining, 20 slices through the Z plane were taken per NMJ and salivary at an interval of 1 μ m. For each samples appropriate settings were chosen for laser power, PMT gain, and offset. Regions of interest were identified from confocal tiles and the composite images of the Z-series were collected. The qualification analysis was completed through ZEN software.

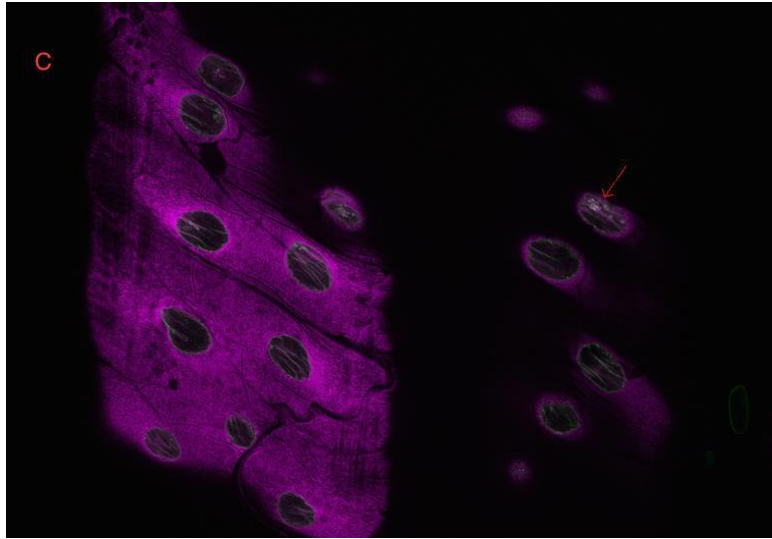
Results:



(A) Larval NMJ labeled with LamDm0 antibody to mark sites where megaRNP granules are in the nucleus.



(B) Larval NMJ expressing Rps3-HA labeled with an anti-HA antibody



(C) Overlay of images A and B showing enrichment of Rps3 at sites where megaRNP granules have formed, suggesting that Rps3 is a component of the granules (see red arrow).

Figure 2. Localization of Rps3 in Larval Muscle Nuclei

GFP tagged RPs	NMJ (x ;;;MhcGal4)	Salivary Gland (x ;;;hsGal4)
RpS9	no enrichment at granules	no enrichment at granules
RpS5a	no enrichment at granules	no enrichment at granules
RpS5a	no enrichment at granules	no enrichment at granules
RpS15	no enrichment at granules	no enrichment at granules
RpS15	no enrichment at granules	no enrichment at granules
RpS13	no enrichment at granules	no enrichment at granules
RpS13	no enrichment at granules	no enrichment at granules
RpS11	no enrichment at granules	no enrichment at granules
RpS11	no enrichment at granules	no enrichment at granules
RpS2	no enrichment at granules	no enrichment at granules
RpS2	no enrichment at granules	no enrichment at granules
FlyORF - 3xHA tagged		
RpS15	no enrichment at granules	no enrichment at granules
RpS5b	no enrichment at granules	no enrichment at granules
RpS15Ab	no enrichment at granules	no enrichment at granules
RpS15Aa	no enrichment at granules	no enrichment at granules
RpS3	enrichment at RNA granules	no enrichment at granules
RpS19a	no enrichment at granules	no enrichment at granules
RpS19b	no enrichment at granules	no enrichment at granules
RpL11	no enrichment at granules	no enrichment at granules
RpS18	no enrichment at granules	no enrichment at granules
RpS25	no enrichment at granules	no enrichment at granules

Table 1: Fluorescent tagged RPs within large RNA granules within the salivary gland, and neuromuscular junction (NMJ) of *Drosophila* larvae.

Discussion

During the past few decades our understanding of mRNA export, the ribosome, and RPs has considerably improved. RNAs and ribonucleoprotein particles (RNPs) were initially thought to access the cytoplasm solely through the NPC, but are now considered to access the cytoplasm through nuclear envelope budding (NEB). Similarly, RPs were initially thought to be involved only in ribosome assembly, but some RPs are now considered to have regulatory functions outside their function in the ribosome. Their roles in cellular functions range from regulation of mammalian body plan to cellular metabolism. Significantly, deregulation in any of these processes may lead to an abnormal phenotype. Unexpectedly, this study reveals that RNA granules within NMJ are enriched with Rps3. Further investigations will be required to reveal the regulatory network associated with Rps3. For instance, the exact mechanisms that control Rps3 and its specific role in the cell are unknown. Therefore, the future in-depth studies are needed to identify the novel functions of Rps3 in megaRNP granules.

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